ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

AUGUST 13, 1949

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•

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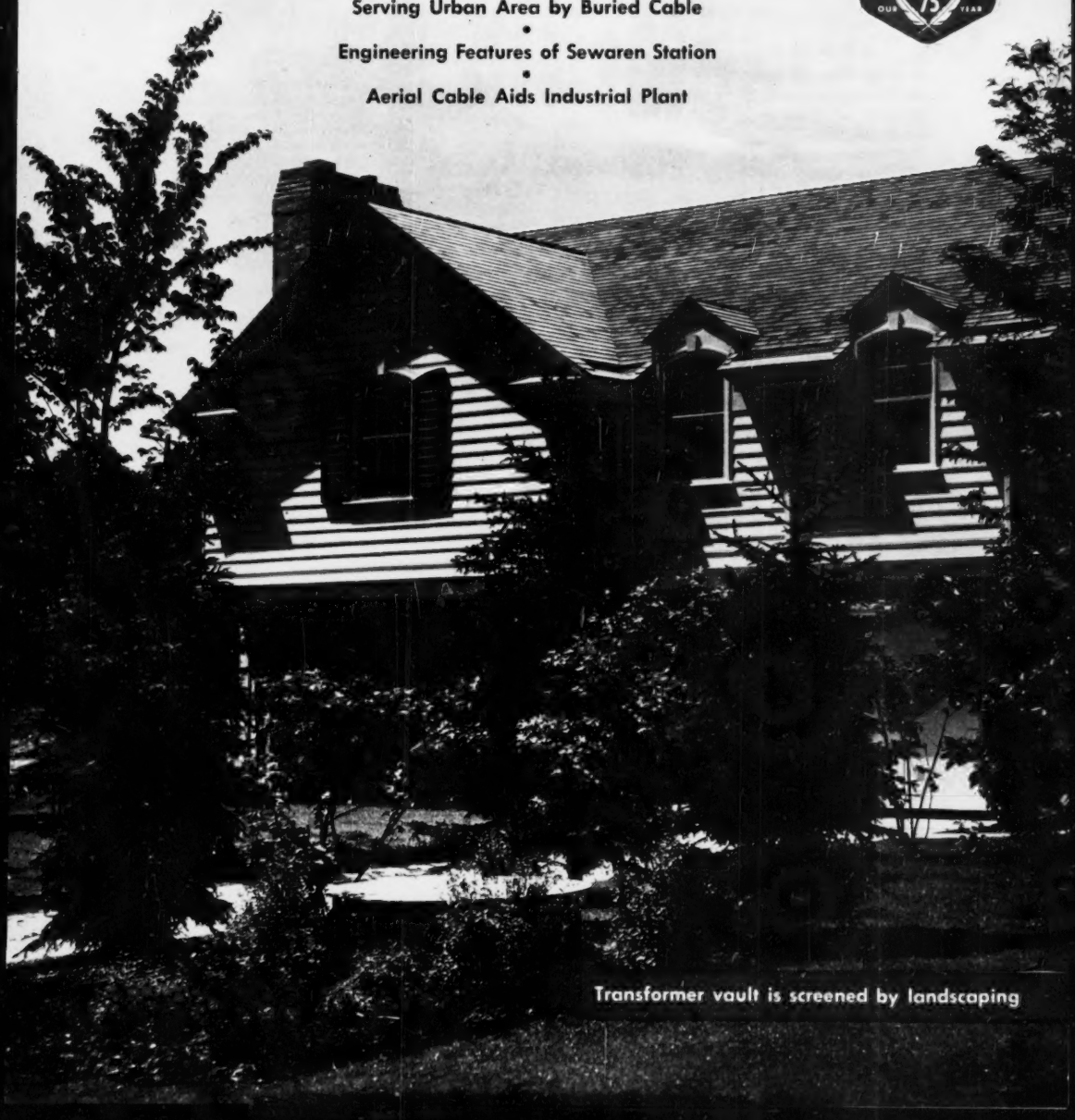

Transformer vault is screened by landscaping

(Model 901) PORTABLE TEST INSTRUMENTS available in DC, Model 901—and AC, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

SENSITIVE RELAYS a line of sensitive relays including the Model 705 which provides positive control at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

(Model 622) ULTRA-SENSITIVE INSTRUMENTS portable DC and AC Thermo instruments for precision measurement of potentials and minute currents involving electronics, thermo-couples or laboratory research.

INSTRUMENTS

TO SPEED AND SIMPLIFY ELECTRONIC PRODUCTION AND MAINTENANCE

Illustrated are but a few of the many specialized instruments available from WESTON . . . all designed to simplify and speed-up electrical and electronic installations, production testing, and maintenance. For details, see your local representative, or write Weston Electrical Instrument Corporation, 618 Frelinghuysen Avenue, Newark 5, New Jersey.

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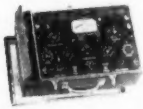
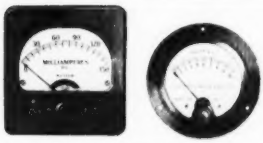
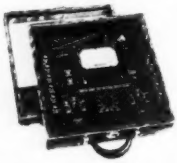


(Model 798) MULTI-PURPOSE TUBE-CHECKER offering provision for testing Receiving Tubes — Voltage Regulator Tubes—Light Duty Thyratron Tubes such as 2A4—6D4—884—885—2051. Scale is calibrated "Good-Bad" as well as in mutual conductance range.



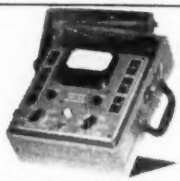
PANEL and SWITCHBOARD INSTRUMENTS a complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including DC, AC power frequencies and radio frequency, rectifier types and D.B. meters.

(Model 697) VOLT-OHM MILLIAMMETER one of a line of pocket-size meters, Model 697 combines a selection of AC and DC voltage, DC current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.



(Model 785) INDUSTRIAL CIRCUIT TESTER a versatile, portable tester for laboratory or maintenance needs, where an ultra-sensitive instrument is required. Provides 27 AC and DC voltage, AC and DC current, and resistance ranges. (DC sensitivity 20,000 ohms per volt.)

(Model 779, Type 1) SUPER-SENSITIVE ANALYZER small, light, compact, 26 range Volt-Ohm-Milliammeter with 5 DC voltage ranges, sensitivity of 1000 or 20,000 ohms per volt. AC temperature compensated. Self-contained power supply. Ideal for many production and test requirements.



(Model 769) ELECTRONIC ANALYZER incorporating a conventional Volt-Ohm-Milliammeter with self-contained power source—a high-impedance electronic Volt-Ohmmeter using 115 volt, 60 cycle power—a stable, probe-type, Vacuum Tube Voltmeter, for use to 300 megacycles.

ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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COVER—For buried cable installations, Public Service Co. of Northern Illinois uses overhead type transformers in above-ground enclosures. In residential areas, vaults are concealed by landscaping that blends with the surrounding architecture

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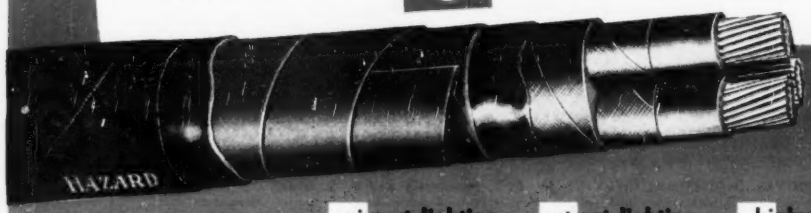
SAVE 4 WAYS WITH HAZARD ARMORTITE CABLE ON THESE 6 IMPORTANT JOBS:



airport lighting . . . street lighting . . . highway lighting . . .
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Lower initial cost. Because Armortite Cable requires no costly lead sheath or metal armor for protection, you make substantial savings on the purchase of cable.

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For all the details about this cable, ask your Hazard representative or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

insulated wires and cables for every electrical use

Electroline-FIEGE Heavy Duty Connectors

WITH A REPUTATION FOR BIG ADVANTAGES

manufactured by Electroline . . . always ahead of the field

Clevis End Type

1 HIGH PRESSURE—*produces HIGH CONDUCTIVITY—gives ultimate electrical characteristics and mechanical strength.*

2 FEATHERED OFF GRIPPING—*damps vibration—increases cable life.*

3 STRONGEST *type of connector when used with steel, copper or composite strands.*

4 NO WASTE—*(a) the connector itself can be used over and over again. (b) no cable wasted by overlapping. Easily disconnected . . . . free from corrosion.*

5 NO SPECIAL TOOLS—*connections made quickly and easily with ordinary linemen's tools.*

6 EASY INSPECTION—*Inspection holes make visual examination of the connection quick and positive. No guess work.*

Bulletins sent on request.

Electroline Company

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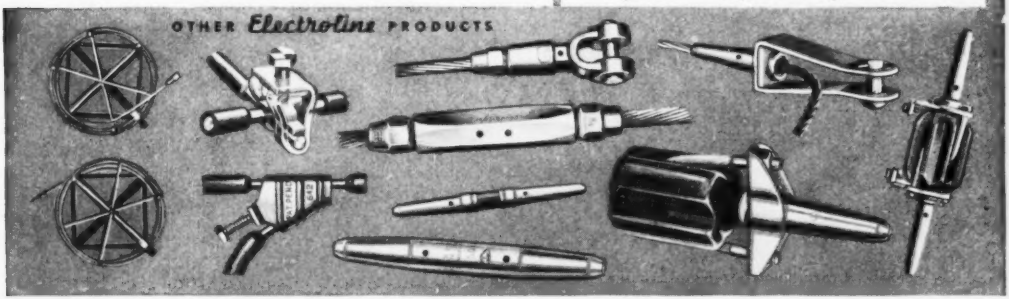
1 SLEEVE—*Cable passed through sleeve.*

2 SLEEVE-PLUG—*Wires broomed out for insertion of hollow plug.*

3 SLEEVE PLUG SOCKET—*Plug driven in and wires closed to apply socket.*

4 CUTAWAY ASSEMBLY—*Socket applied showing "Fiege Twist" and completed assembly.*

OTHER *Electroline* PRODUCTS



Because of Their:

SIMPLE CONSTRUCTION:

— Simplex - **ANHYDROPRENE** Cables up to 5 KV. consist only of a coated copper conductor, Anhydrex insulation, and a thin neoprene jacket. They're light in weight, small in diameter, easy to work with.

SOUND PROPERTIES:

— High dielectric strength and exceptional stability in water are features of Anhydrex insulation. Protection against abrasion, corrosive chemicals, light, heat, and flame is provided by the neoprene jacket.

VERSATILITY:

— **ANHYDROPRENE** Cables can be racked on walls, installed in conduit, and used underground in ducts; no need to stock a variety of cables for different applications in your electric systems.

For complete information about ANHYDROPRENE Cables write us today for Bulletin 115.

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are being specified more and more for plant and shop wiring, instrument wiring, underground primaries and secondaries, transformer leads, pole line risers, signal and control circuits.

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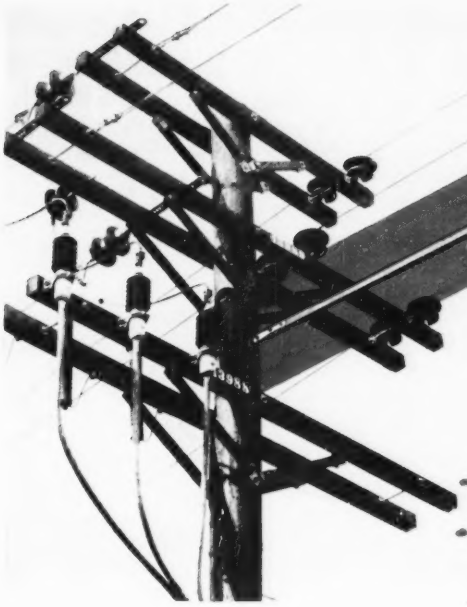
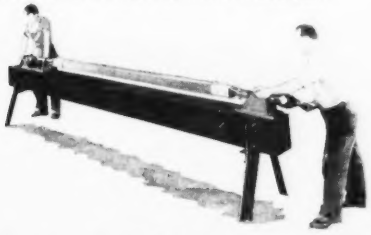


why LOCKE wood guy insulators give you

-a higher margin of safety, -a greater value per dollar!

Dependability is "In the wood"

The photograph shows a cross section of a Locke Wood Guy Insulator. Finest Douglas Fir resists rotting and insect infestation — thin, uniform growth rings give highest strength, maximum protection against structural flaws. Quality wood plus greatest cross sectional area give Locke Wood Guy Insulators highest dependability. (Creosote or Penta treatment if desired.)



Tension-Tested for Reliability

Every Locke Wood Guy Insulator is individually tension-tested to its full working load rating before shipment. This is your best guarantee that each will do a reliable job in actual use.

Locke Wood Guy Insulators come in three general types—light, medium and heavy—include sizes with working loads from 6,000 to 18,000 lbs. End fittings are clevis type for easy installation.

You get a higher margin of safety . . . because Locke Wood Guy Insulators have a low stress loading per square inch of wood cross section—*a greater value per dollar* because Locke Wood Guy Insulators have a *low overall price* based on published ultimate strengths.

Made only of tough, top grade Douglas Fir—equipped with fittings galvanized by Locke's special double-dip Permazinc method — Locke Wood Guy Insulators are built to last. And through greater area of wood cross section, individual tension-testing—they give you *extra* safety, *proven* protection. For the best buy in guy insulation—specify Locke Wood Guy Insulators.

Write today for the new LOCKE TECH REPORT ON WOOD GUY INSULATORS. Gives complete engineering story . . . supported by comparative facts and figures.

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INCORPORATED
BALTIMORE, MARYLAND

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Now Ready!!!

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AND AWAITING YOUR REQUEST...

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ADDED SPEEDS . . . NEW "ALL-IN-ONE" PACKAGE PRESENTATION — These comprise another outstanding engineering service offered by S&C to satisfy an industry-wide desire for better power fusing information.

Packaged in convenient, indexed, folders punched for insertion in a loose-leaf binder, filed in a visible arrangement that protects and yet permits rapid selection of each sheet, and separated by product line, a total of 58 time-current curve sheets are offered providing the following information:

1. NEW TOTAL-CLEARING, Minimum-Melting, and Short-Time Rating Curves, accurately drawn on fine scale NEMA grids, identified by color, and printed on transparent paper, ideal for tracing and reproduction, or light-table comparisons.

2. REFUTATION of the notion that short-time curves or "set-back" allowances are essential in the coordination of *all* fuses—such allowances being unnecessary with "non-damageable" fusible elements, obtainable only in S&C fuses.

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6. HIGHER AMPERE RATINGS.

The growing need for, and increasing importance of, this more detailed, more accurate, fuse coordination data was created by the

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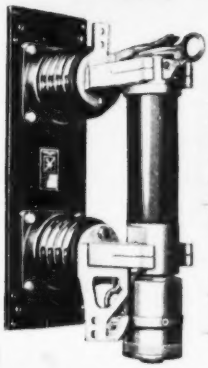
namely, *Full Coverage*, in which a primary fuse is applied for *both* primary short circuit and secondary backup short circuit protection.

This practice requires a "non-damageable" fusible element, dependable low-fault-current interrupting ability, ability to function dependably under conditions of severe recovery voltage, and a fine degree of accuracy in time-current characteristics—a combination of qualities found only in S&C fuses.

For your *free* Time-Current Characteristic Folders pictured on the opposite page please write, on your business letterhead, TODAY!!!

S&C ELECTRIC

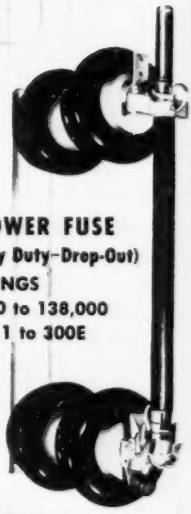
CURRENT INFORMATION FOR POWER FUSING



SM POWER FUSE
(Boric Acid—Heavy Duty)
RATINGS
Volts: 7500 to 34,500
Amperes: ½ to 800E

LIQUID POWER FUSE
RATINGS
Volts: 7500 to 138,000
Amperes: ½ to 250E

HSO POWER FUSE
(Boric Acid—Drop-Out)
RATINGS
Volts: 7500 to 69,000
Amperes: 1 to 200E



SMD-2 POWER FUSE
(Boric Acid-Heavy Duty-Drop-Out)
RATINGS
Volts: 34,500 to 138,000
Amperes: 1 to 300E

COMPANY 4421 Ravenswood Avenue
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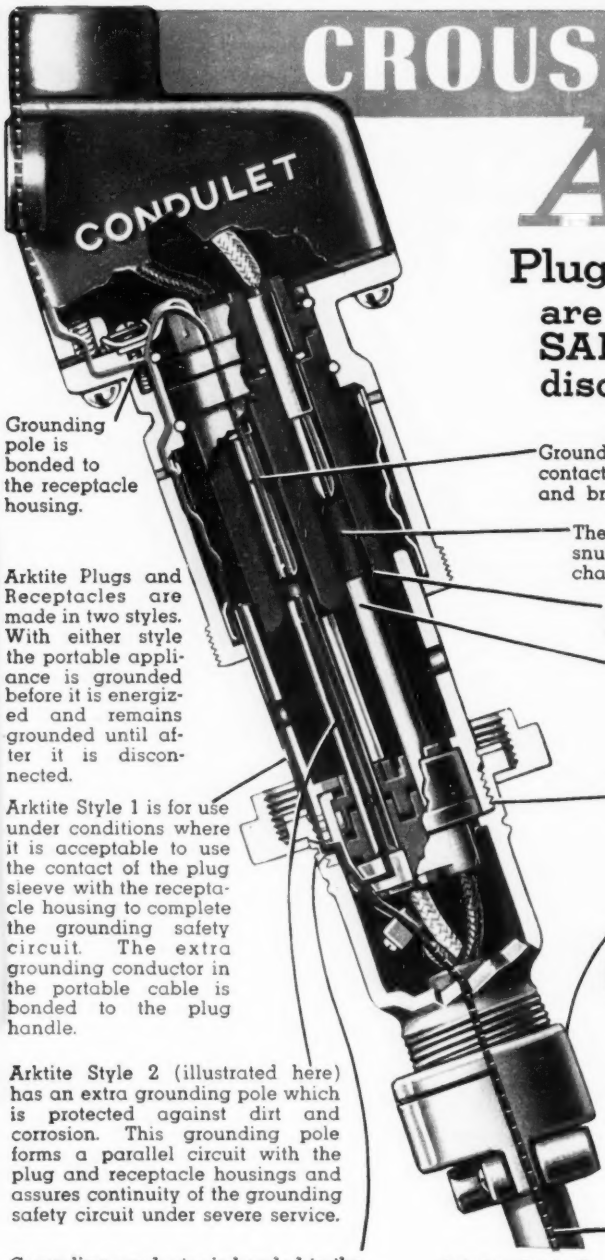
CROUSE-HINDS Arktite

Plugs and Receptacles are circuit breaking and SAFE without additional disconnect equipment.



Grounding pole is bonded to the receptacle housing.

Arktite Plugs and Receptacles are made in two styles. With either style the portable appliance is grounded before it is energized and remains grounded until after it is disconnected.

Arktite Style 1 is for use under conditions where it is acceptable to use the contact of the plug sleeve with the receptacle housing to complete the grounding safety circuit. The extra grounding conductor in the portable cable is bonded to the plug handle.

Arktite Style 2 (illustrated here) has an extra grounding pole which is protected against dirt and corrosion. This grounding pole forms a parallel circuit with the plug and receptacle housings and assures continuity of the grounding safety circuit under severe service.

Grounding conductor is bonded to the plug handle.

Grounding pole is longer than the others so contact in the grounding circuit is made first and broken last.

The arc formed by pulling the plug is instantly snuffed in the confined insulated arcing chamber.

Each plug contact fits closely the opening of its individual arcing chamber.

The arc is broken while the plug contact is still a considerable distance inside of the arcing chamber. There is no danger of the arc traveling over to the other side of the circuit or to the housing.

Two-piece plug is easy to take apart and reassemble.

Direct-pressure clamp insures positive grip on the conductor cable.

CROUSE-HINDS offers the only complete line of circuit breaking plugs and receptacles—20 Amp. to 400 Amp., 250 volt D.C., 600 volt A.C.

Complete listings are in the Condulet Catalog.

The green line indicates the grounding safety circuit.

Arktite Style 2. Sectional View

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NEW SQUARE D "PLUG-IN" CONTROL CENTERS

above
• Size 2 plug-in starter unit

right
• Disconnect operator handle

***NOW**...take full advantage of Control Center convenience, safety and economy . . . Square D "PLUG-IN" centers are new from the ground up, with all basic features plus . . .*

NEW ***INSTALLATION ECONOMY.*** Wiring channels are all accessible from front without removing units. Two big vertical channels per section permit separation of power and control circuits.

NEW ***SPACE ECONOMY.*** Up to six starters fit in 20" x 20" x 90" sections. Standard 20" depth sections will accommodate starters through size 5.

NEW ***SAFETY DISCONNECT OPERATOR.*** One to four padlocks will lock both door and disconnect in either "ON" or "OFF" position. On closing unit door, handle moves to indicate position of disconnect. When not padlocked, authorized person with tool can release door interlock to inspect control without interrupting power.

NEW ***FLEXIBILITY.*** For simplest plant conversion or maintenance, plug-in units slide on guide brackets and positive pressure stabs grip round vertical busses. Plant conversion is simplified and minor changes often will not require shutting off power.

Square D's NEW Control Centers are also available in water-tight, dust-tight and weather-resistant enclosures. Contact your nearby Square D Field Engineer for complete information, or

***Write** Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin*

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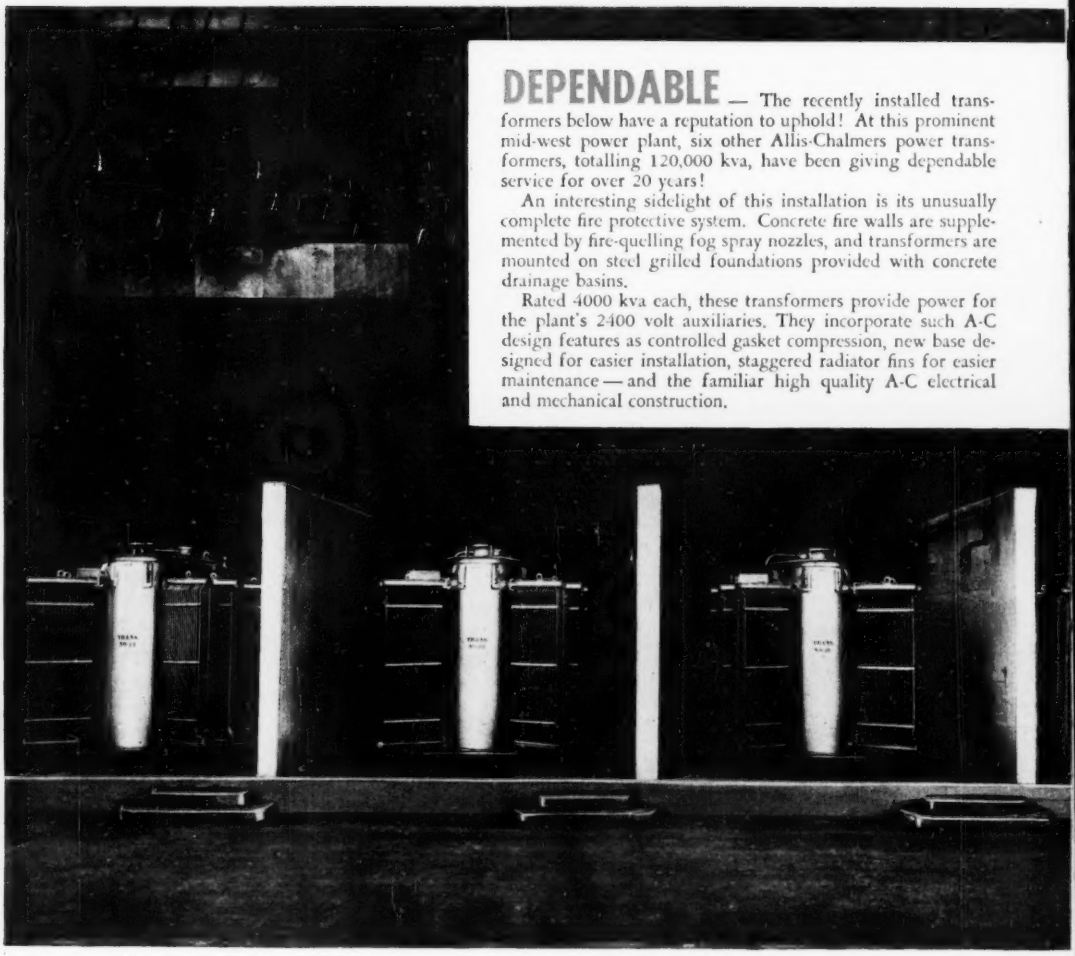
ALLIS-CHALMERS

Dependable Because



DEPENDABLE — The recently installed transformers below have a reputation to uphold! At this prominent mid-west power plant, six other Allis-Chalmers power transformers, totalling 120,000 kva, have been giving dependable service for over 20 years!

An interesting sidelight of this installation is its unusually complete fire protective system. Concrete fire walls are supplemented by fire-quelling fog spray nozzles, and transformers are mounted on steel grilled foundations provided with concrete drainage basins.

Rated 4000 kva each, these transformers provide power for the plant's 2400 volt auxiliaries. They incorporate such A-C design features as controlled gasket compression, new base designed for easier installation, staggered radiator fins for easier maintenance — and the familiar high quality A-C electrical and mechanical construction.

...means Quality Power Transformers

Circular coils withstand high stresses. Coils are rigidly braced, vacuum dried and treated.

"Capacity Tailored" Load Ratio Control, featuring Allis-Chalmers 32-step regulation.

Controlled gasket compression insures correct pressure . . . increases life, effectiveness.

Strong, fin-type radiators rigidly braced. Staggered construction simplifies repainting.

Proved Oil-Sealed Inert Gas Protection provides simple, positive oil preservation.

Power Transformers..
They're Quality-Built!

QUALITY-BUILT — Shown under construction at right is one of the largest transformers ever built. A special low body transformer car was needed to meet railroad clearances during shipment to its Midwestern installation site.

Size of the transformer favored side mounting of the *Oil-Sealed* inert gas protective system . . . serving the double purpose of bringing gauges into easier reading position and increasing overhead line clearances.

* * *

Whether it's a bank of auxiliary transformers, or one of the world's largest, Allis-Chalmers facilities for building power transformers *of any rating* are second to none. For the factual story of how Allis-Chalmers builds quality into power transformers, write direct for bulletin B6402. A-2775

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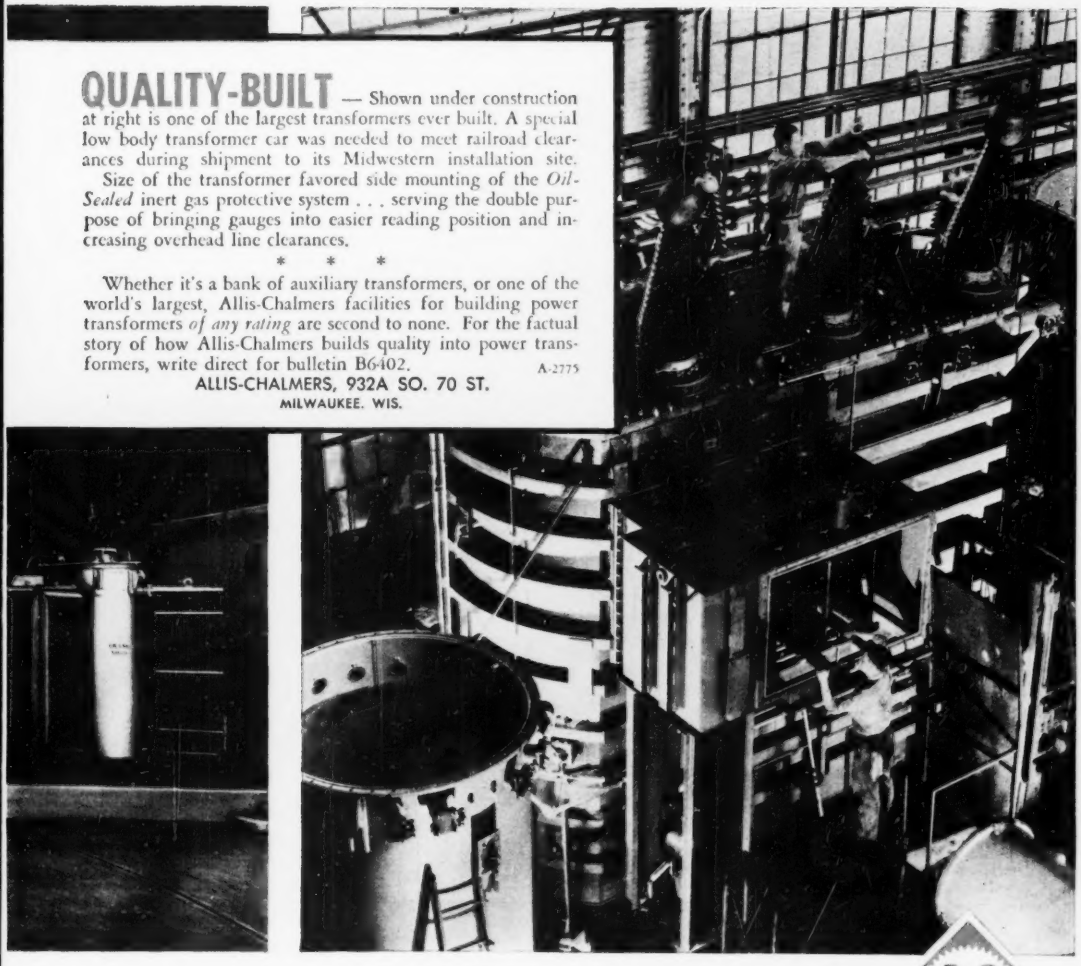
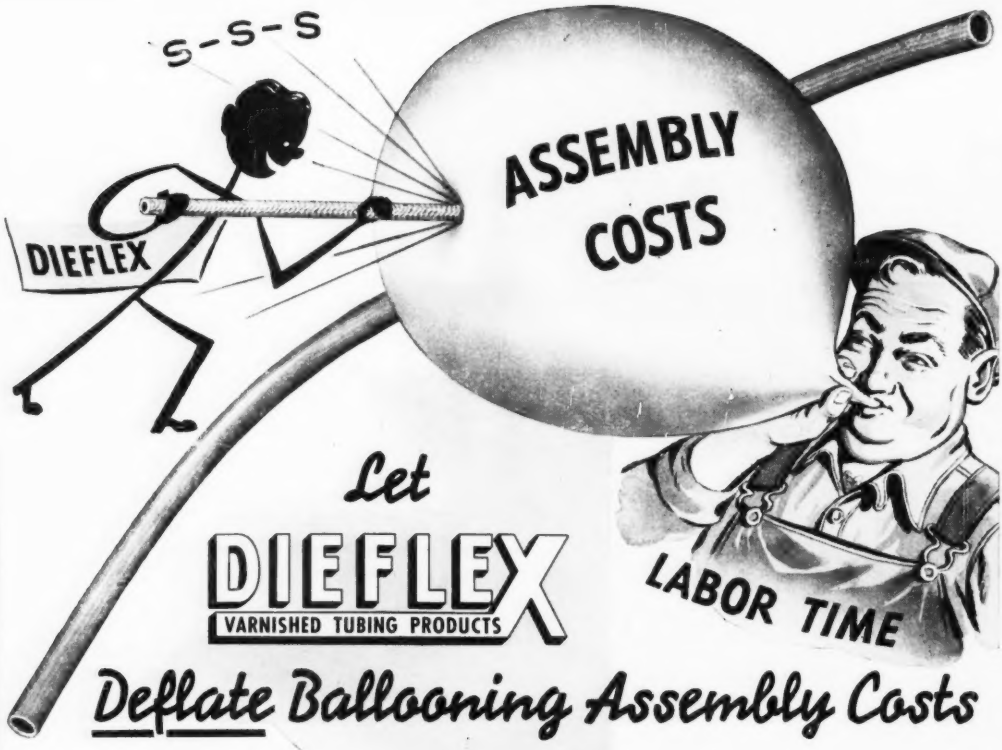


ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment From Generation Through Utilization



Let

DIEFLEX

VARNISHED TUBING PRODUCTS

Deflate Ballooning Assembly Costs

You'll be amazed how labor costs shrink when you use Dieflex Varnished Tubing products to save assembly time. Test the flexibility and stretch of Dieflex . . . see how quickly it slides over rough joints and around sharp bends . . . see how its smooth bore prevents snagging . . . how it cuts cleanly without fraying. All these features add up to easier handling and rock bottom assembly costs.

Now, beyond assembly—you can expect fewer breakdowns, reduced repair costs, minimum lost production, because Dieflex gives top mechanical and dielectric protection. Write or phone the sales office nearest you, and start deflating assembly costs today. A folder giving technical information on Dieflex products will be sent upon request.

Braided glass base varnished tubings and saturated sleevings are as inexpensive as corresponding grades of cotton base varnished tubings and saturated sleevings.

DIEFLEX PRODUCTS LIST

MADE WITH BRAIDED COTTON SLEEVING BASE

Grade A-1 Magneto Grade Varnished Tubings
Grade B-1 Standard Grade Varnished Tubings
Grades C-1 and C-2 Heavily Coated Saturated Sleevings
Grade C-3 Lightly Coated Saturated Sleevings
Heavy Wall Varnished Tubings and Saturated Sleevings

MADE WITH BRAIDED GLASS SLEEVING BASE

Grade A-1 Magneto Grade Varnished Glass Tubings
Grade C-1 Extra Heavily Saturated Glass Sleevings
Grade C-2 Heavily Saturated Glass Sleevings
Grade C-3 Lightly Saturated Glass Sleevings
Silicone-Treated Glass Varnished Tubings and Sleevings

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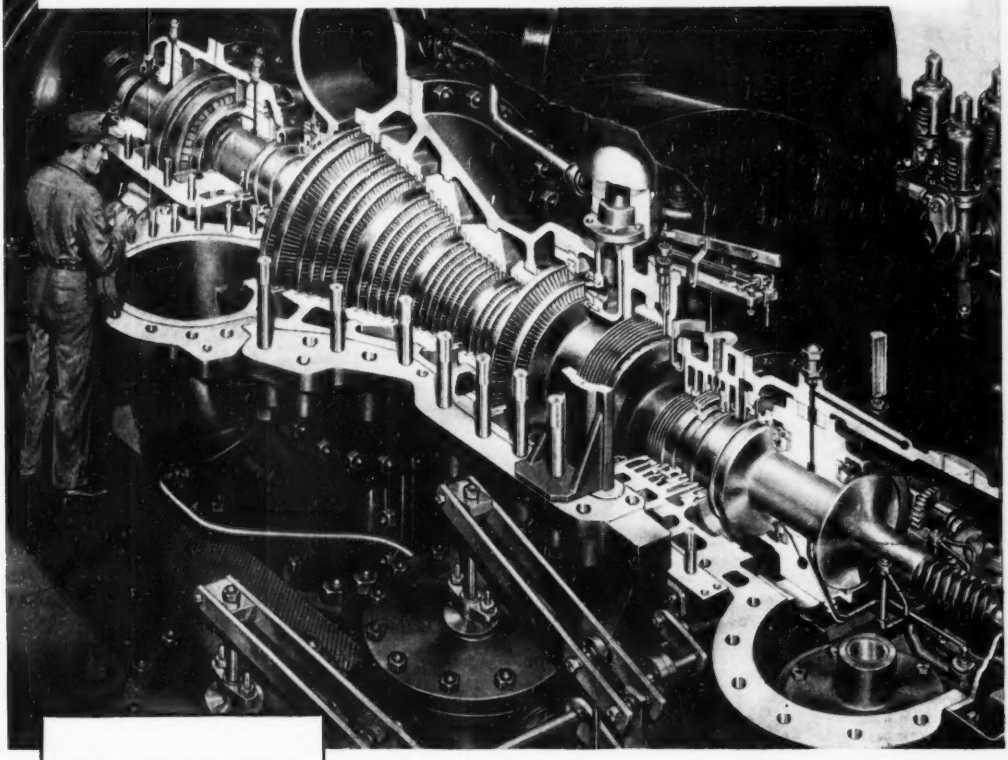
ELECTRICAL IMC INSULATION

635 TURBINES

Set Records with Gargoyle D.T.E. Oil 797



FAMOUS SOCONY-VACUUM TURBINE OIL PROVED OVER 7-YEAR PERIOD!

★

Practically Half of All New Units Getting this Great Product

★ ★

Operators using other Gargoyle Oils for Auxiliary Equipment

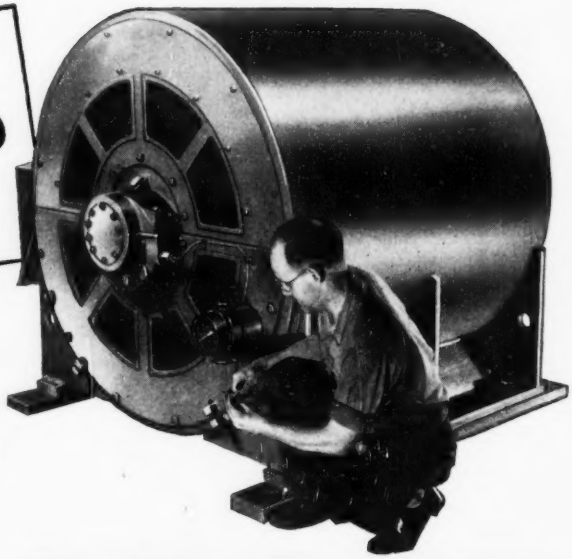
Now it's in 635 turbines—Gargoyle D.T.E. Oil 797. And it's setting performance records undreamed of a few years ago. In seven years, not a single turbine taken out of service because of the condition of the oil. No appreciable change in the oil. But no wonder—this great product is made from a base stock that is in itself an excellent turbine oil with natural resistance to oxidation and foaming. To this stock, we've added still greater resistance to oxidation . . . and maximum protection against rust. It's one of the best, the safest turbine oil ever developed. Put it in your turbine now.

SOCONY-VACUUM GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC.
and Affiliates: MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORPORATION

Rely on **SOCONY-VACUUM** *Correct Lubrication*

TUBE-TYPE TOTALLY-ENCLOSED FAN-COOLED MOTORS!

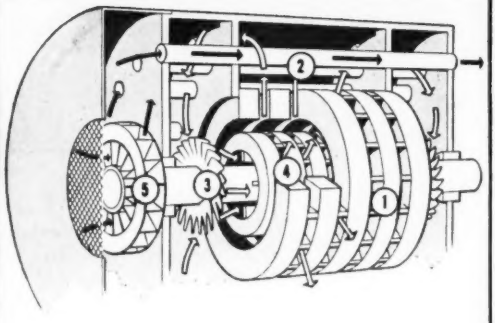


DIRT-

AND CORROSION-RESISTANT!

PROOF!

How Tube Cooling Works



Stator core (1) is surrounded by tubes (2). Internal fans (3) circulate air through ducts (4) in rotor and stator and around tubes, transferring heat to tubes.

External fan (5) drives outside air through tubes, removing heat and keeping tubes clean. All electrical parts are enclosed. Dirt cannot enter.

*Totally-Enclosed Fan Cooled

- **Install anywhere – indoors or out**
- **Heat exchanger is practically *self-cleaning***
- **Sizes . . . 75 to several thousand horsepower**

THIS ALLIS-CHALMERS tube-type TEFC* motor practically eliminates cleaning and other high maintenance costs associated with large motors exposed to dirty and corrosive atmospheres. And it does this with a simple, self-contained, tube-type, ventilating system.

All electrical parts — including the stator core — are enclosed. The simple heat transfer system keeps temperatures well within rated limits. Cleaning is rarely needed because air passages are unrestricted. Air flow through the straight tubes removes foreign matter.

Three years of field operation have proved important savings. Sizes from 75 hp and up. Also explosion-proof designs. For complete information, outline your requirements to your A-C Sales Office, or write for Bulletins 05B7150 and 51R7149. A 2664

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

NOW—A Better Ground Rod because It's Blackburn-Built!

BLACKBURN Copper-Clad GROUND ROD

Completely Covered, Molecularly Bonded, to Insure Dependable, Permanent Grounding

Note uniform copper covering, molecularly bonded to steel. Cross section of copper is greater than No. 4 wire.

1 **A stronger, more rigid rod for better driving.** Made with stronger, stiffer steel core, having a higher carbon content than any other rod.

2 **Completely covered, including top and bottom, to fully protect steel core.** Has a heavy, non-porous and uniform covering of pure copper, which is thoroughly bonded to the steel core, and will not peel off when driven.

3 **Rolled finish produces hard, scar-resistant surface.**

4 **Fully approved by REA.**

5 **Now available for prompt delivery.** Made in sizes ½ x 8, ½ x 10, ⅝ x 8, ⅝ x 10, ¾ x 10.

6 **Backed by Blackburn's reputation for quality.**

BUILDERS OF QUALITY PRODUCTS FOR 15 YEARS

Jasper Blackburn Products Corp.
First, Madison and Clinton Sts.
ST. LOUIS 6, MISSOURI

Mail Coupon Now for Sample Section

JASPER BLACKBURN PRODUCTS CORP.,
First, Madison & Clinton Sts. • St. Louis 6, Mo.

Send me, without obligation, a sample section of your Blackburn Copper-Clad Ground Rod, prices, and name of nearest jobber.

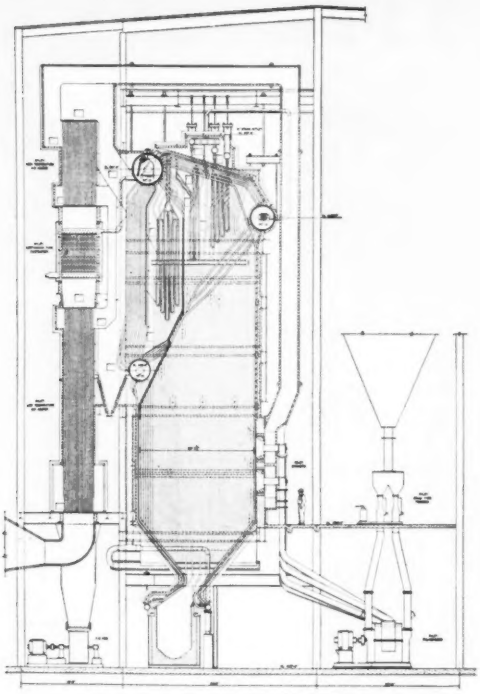
Individual Name & Title _____

Firm Name _____

Address _____

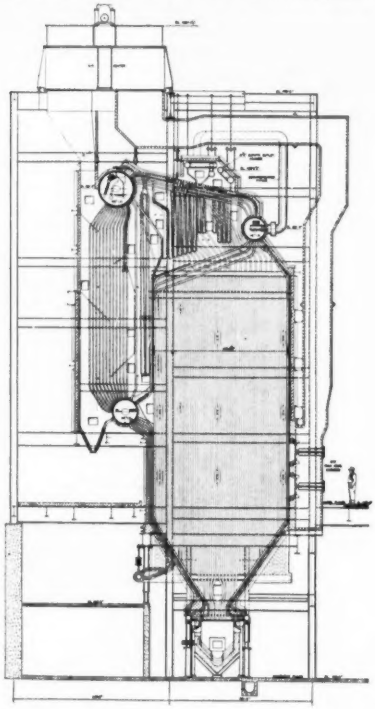
_____

A Few Recent RILEY



NORTHERN VIRGINIA POWER CO., Riverton Station
350,000 lbs./hr. 1050 lbs. 900°F.
Sanderson & Porter, Engineers

PUBLIC SERVICE CO. OF INDIANA, Edwardsport, Ind.
400,000 lbs./hr. 1000 lbs. 910°F.
Sargent & Lundy, Engineers
Public Service Co. of Indiana is also installing
Riley Units in their Dresser and Noblesville plants



All of these Public Utilities have recently ordered Riley Steam Generating Units

HOUSTON LIGHTING & POWER CO.
West Junction Station, 2—850,000 lbs./hr.
Gable Street Station, 1—350,000 lbs. hr.
Greens Bayou Station, 2—675,000 lbs./hr.

CENTRAL OHIO LIGHT CO.
Bluffton Station, 1—120,000 lbs./hr.

UPPER MICHIGAN POWER & LIGHT CO.
Escanaba Station, 1—150,000 lbs. hr.

GULF POWER COMPANY
Pensacola Station, 2—230,000 lbs./hr.

PUBLIC SERVICE CO. OF INDIANA
Dresser Station, 1—300,000 lbs. hr.
Noblesville Station, 3—300,000 lbs. hr.
Edwardsport Station, 2—400,000 lbs. hr.

IOWA-ILLINOIS GAS & ELECTRIC CO.
Davenport Station, 3—250,000 lbs. hr.
Iowa City Station, 1—60,000 lbs./hr.

INTERSTATE POWER CO.
Lansing Station, 2—120,000 lbs. hr.
Fox Lake Station, 2—120,000 lbs. hr.

WORCESTER COUNTY ELECTRIC CO.
Webster Street Station, 1—325,000 lbs. hr.

TRADE MARK Rx REGISTERED

RILEY

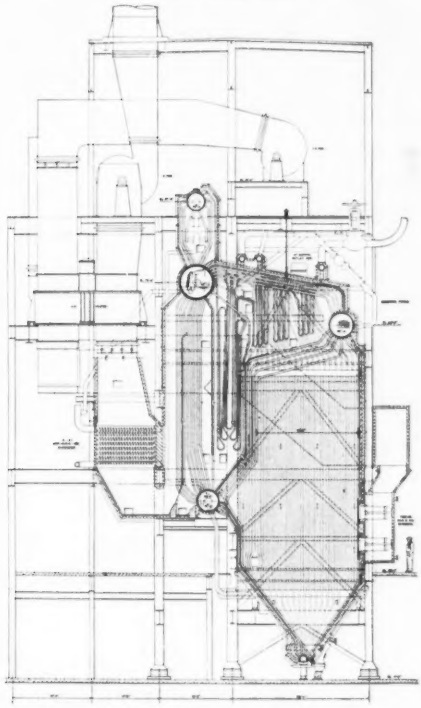
STOKER CORPORATION, WORCESTER, MASS.

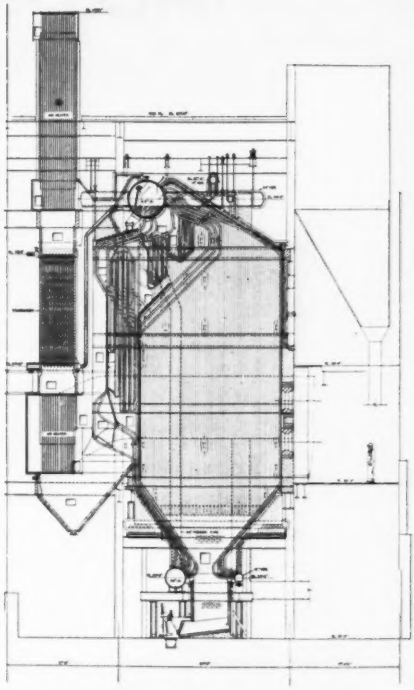
Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

Central Station Units

CITY OF LOS ANGELES, CALIF., Harbor Steam Plant
825,000 lbs./hr. 1200 lbs. 900°F.
With the addition of these three units,
Harbor Steam Plant will have 3,825,000 lbs. of steam
capacity of Riley Units





CENTRAL ILLINOIS LIGHT CO., Peoria, Ill.
(Commonwealth & Southern Corp.)
300,000 lbs./hr. 925 lbs. 900°F.
With the installation of these two units, Central Illinois
Light Co. will have four Riley Steam Generating Units in
this station

OTTER TAIL POWER CO.
Devils Lake Station, 1—75,000 lbs. hr.
Crookston Station, 2—75,000 lbs. hr.
Wahpeton Station, 1—100,000 lbs. hr.
Hoot Lake Station, 1—160,000 lbs. hr.

SOUTHWESTERN PUBLIC SERVICE CO.
Borger, Texas, 1—330,000 lbs./hr.

NEW ORLEANS PUBLIC SERVICE CO.
Market Street Station, 1—330,000 lbs./hr.

SOUTH CAROLINA POWER CO.
Charleston Station, 2—230,000 lbs. hr.
1—310,000 lbs. hr.

CENTRAL ILLINOIS LIGHT CO.
Peoria Station, 2—300,000 lbs. hr.
1—600,000 lbs. hr.
Springfield Station, 1—125,000 lbs./hr.

ARKANSAS POWER & LIGHT CO.
Cecil Lynch Station, 1—650,000 lbs./hr.

UTAH POWER & LIGHT CO.
Orem Station, 1—450,000 lbs./hr.
Jordan Station, 1—620,000 lbs./hr.

MISSISSIPPI POWER CO.
Hattiesburg Station, 3—230,000 lbs./hr.

OHIO EDISON CO.
Mad River Station, 1—250,000 lbs. hr.
Beech Street Station, 1—90,000 lbs. hr.

NORTHERN VIRGINIA POWER CO.
Riverton Station, 1—350,000 lbs. hr.

CITY OF LOS ANGELES
Harbor Steam Station, 3—825,000 lbs. hr.

UNION ELECTRIC CO. OF MISSOURI
Ashley Street Station, 3—310,000 lbs. hr.

WEST PENN POWER CO.
Milesburg Station, 2—210,000 lbs. hr.

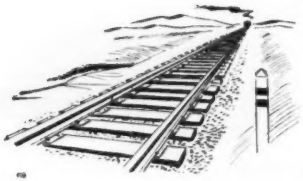
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in [illegible] costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Here's a Wood Preservative You KNOW will work

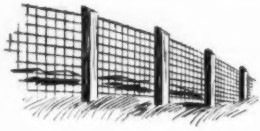


With today's high cost of lumber, it becomes more vital than ever to use a wood preservative of *proved* dependability.

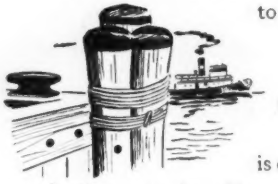
Creosote Oil meets this requirement outstandingly. It is the most widely used wood preservative in the world.

Properly applied, Creosote Oil extends the life of wood 3 to 5 times, or more. Its deep penetration protects wood from dry rot, fungi, termites and other destructive pests.

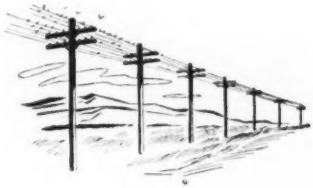
Creosote Oil is the only wood preservative that has been successfully used under practically all conditions for more than 100 years.



For these reasons, Barrett continues to recommend pressure treatment with Creosote Oil as the most dependable wood-preserving method for users who *must* be able to count on the results. For these reasons, also, Creosote Oil continues to be the wood preservative that is preferred by leading railroads and utilities for the protection of ties, poles and structural timber. When a demonstrably better method of preserving wood is developed, to the point where it can be recommended for the protection of large lumber investments, you may be sure Barrett will sponsor it.



Today, as for the last 100 years, Creosote Oil is the most reliable safeguard of your lumber investment.



PENETRATES to the HEARTWOOD

THE BARRETT DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 Rector Street, New York 6, N. Y.

Barrett*

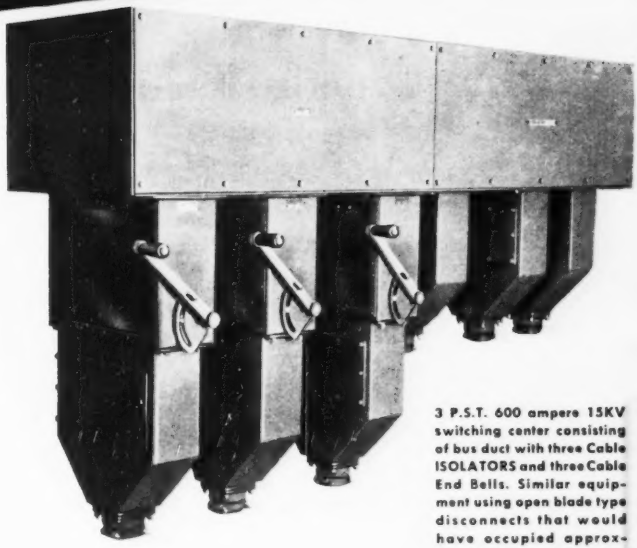
*Reg. U. S. Pat. Off.

ENGINEERED SPACE SAVER!

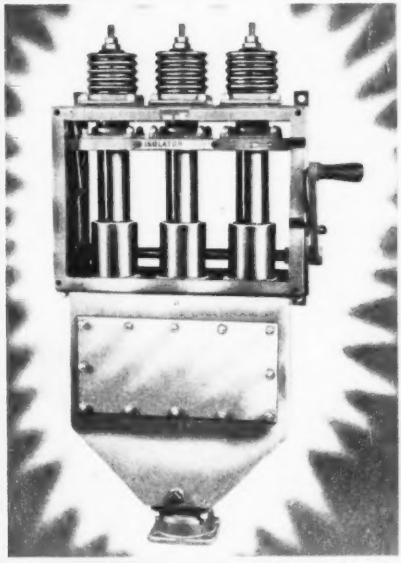
With building costs what they are today, it is highly desirable that structures for housing of electrical switchgear be made as small as possible consistent with proper electrical clearances.

Under such circumstances the ISOLATOR fills a definite need.

Likewise the matter of finding space in existing structures is a problem often solved by using ISOLATORS



3 P.S.T. 600 ampere 15KV switching center consisting of bus duct with three Cable ISOLATORS and three Cable End Bells. Similar equipment using open blade type disconnects that would have occupied approximately twice the space.

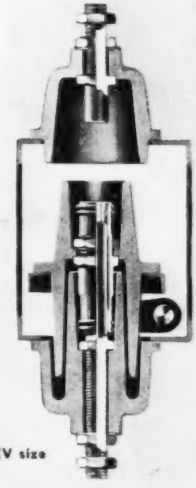


3 P.S.T. 600 ampere 15KV Cable ISOLATORS built as a separate unit.

You Can Do It Better With An ISOLATOR

Because of its unique telescoping action of both contact and insulating bushings, the ISOLATOR occupies approximately ⅓ to ½ the space taken up by comparable open blade switch equipment. This is a fact worth remembering when you have a space problem.

Our new Bulletin 140 contains 40 pages of information concerning the ISOLATORS. Send for it today and find out how the ISOLATORS can make savings for you in other ways.



Cross sectional view of the ISOLATORS, 5KV size shown.

THREE ELECTRICAL ENGINEERS EQUIPMENT CO. MELROSE PARK ILL. U.S.A. THE MARK OF QUALITY

ELECTRICAL ENGINEERS EQUIPMENT CO.

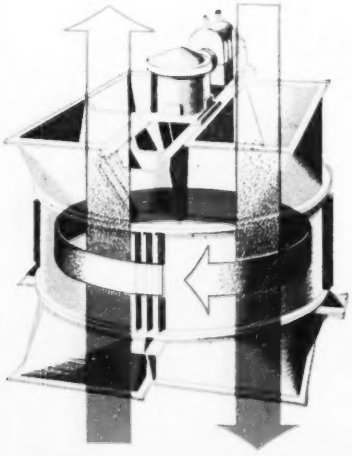
MELROSE PARK, ILLINOIS

Fact File on Preheat

No. 2

In the Ljungstrom Air Preheater, air and flue gases are each uniformly distributed as they flow through the heating surface. This uniform flow through the rotating heating element maintains nearly constant temperatures at any given cross-section. "Cold spots," which often initiate plugging, do not exist at any part of the heat exchange surface.

LJUNGSTROM



The Ljungstrom Air Preheater is a compact gas-to-air or gas-to-gas heat exchanger, operating on a continuous regenerative counterflow basis. Hundreds of power plants and other special applications confirm its high level of heat recovery and long-term service at low maintenance expense.

THE

AIR PREHEATER CORPORATION

60 EAST 42ND STREET · NEW YORK 17, N. Y.

Plant: Wellsville, N. Y.

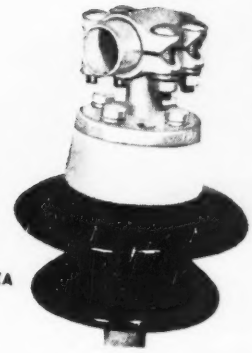
960

PACIFIC ELECTRIC
BUS FITTINGS
and BUS SUPPORTS

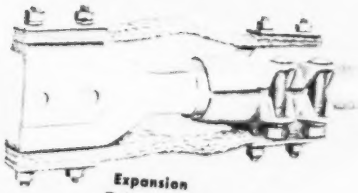
Made by Specialists in the Manufacture of High-Voltage Oil Circuit Breakers and Air Switches

VEX

VKA



VXA



Expansion Tube to Bar

*Pacific Electric Features**

Cast to Size . . .
To insure highest conductivity when applied to tubes having the usual variation of diameter within tube-manufacturer's tolerance limits.

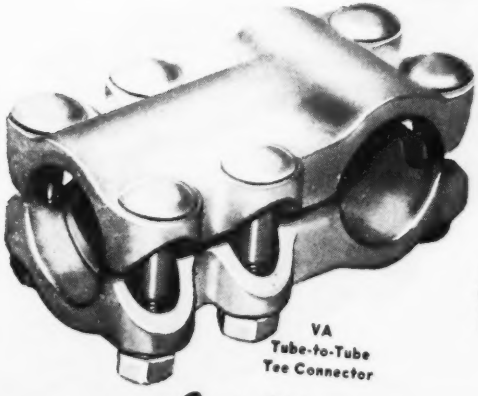
Bolts Cannot Drop Out During Installation . . .
Special retainers hold bolts firmly in caps.

Rounded Edges . . .
Reduce junction-fatigue failure.

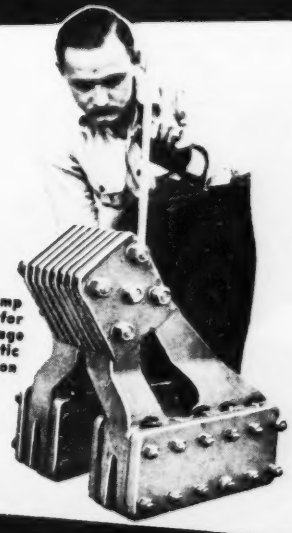
One-Wrench Tightening . . .
Oval-shank bolts in oval holes prevent shank from turning.

Pressed-On Ferrules . . .
Expansion flexibles have precision-made ferrules applied under 60-tons pressure.

**Applying to most designs of copper-alloy fittings; those for aluminum conductor differ slightly.*



VA
Tube-to-Tube
Tee Connector



20,000-amp Terminal for Low-Voltage Electrolytic Installation

Stud to Cable

Just Off the Press: Ask for new Catalog 710 . . . 28 pages of specifications and dimensioned illustrations of Pacific Standard-Line of Bus Fittings and Supports.

Get All Facts . . .

Call

PACIFIC ELECTRIC MFG. CORPORATION

5815 THIRD STREET, SAN FRANCISCO 24, CALIFORNIA • P. O. BOX 419, GARY, INDIANA

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G. B. KIRKWOOD, 437 S. Hill St., Los Angeles 13, Calif.
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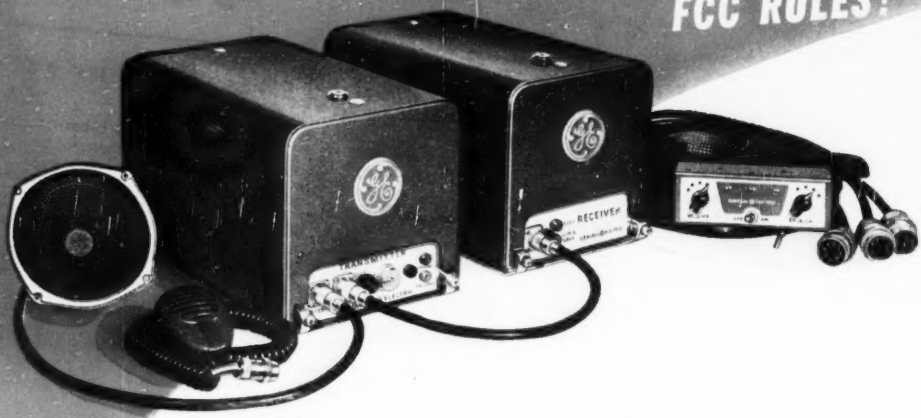
MYRON SWENDSEN, P. O. Box 156, Boise, Idaho
EDGAR F. HUBERT CO., 510 Statler Bldg., Boston 16, Mass.
BRUECK ENGINEERING CO., 53 W. Jackson Blvd., Chicago 4, Ill.
C. C. MUSGROVE, 508 Southland Bldg. Annex, Dallas 1, Texas
KRIPPNER and POLLEY, 1 Downing St., Denver 9, Colo.
L. C. HARDIE, P. O. Box 1871, Des Moines 8, Iowa

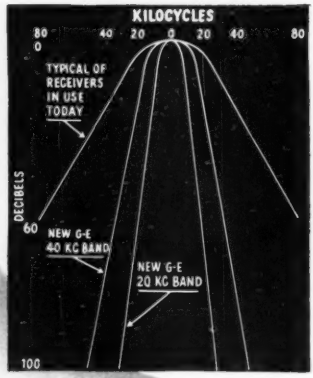
Other Representatives in Principal Cities

Announcing

A 2-WAY RADIO THAT MEETS OR EXCEEDS ALL NEW FCC RULES!



New 25-50 MC EQUIPMENT FOR 20 KC OR 40 KC CHANNELS



HERE'S WHY IT'S SO GOOD! ● Permits double the number of usable channels in the same spectrum space. With it you can take advantage of a national allocation plan, set up on 20 kc channels, to reduce skip interference ● Extends your communication range. Weak signals come through "loud n' clear" because of the famous G-E wide-crown receiver response curve ● Includes instantaneous modulation control, which automatically compensates for loud or soft, high or low pitched voices. Holds transmission inside assigned channel—thus meeting FCC requirements well in advance of the deadline.

FCC and INDUSTRY ASKED FOR IT—HERE IT IS!

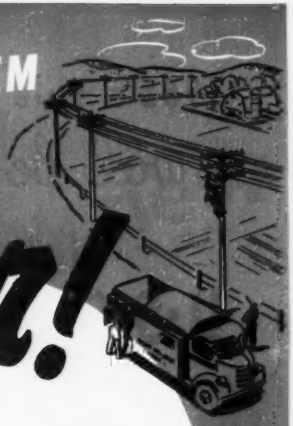
The FCC Order of May 6, 1949 emphasized the need for equipment that would operate on closer spacing than 40 kc. The new G-E equipment shown here meets this need NOW. In chart at left note how closely the G-E curve approaches the ideal flat-top, straight-side response. In recent tests, G-E 20 kc equipment completely eliminated off-channel skip interference: skip signals did not even open the receiver squelch!

You can put your confidence in—

GENERAL ELECTRIC

TEST IT IN YOUR PRESENT SYSTEM WITH OUR GENEROUS

Trial Offer!



AFTER two years of intensive engineering and rigorous performance tests, these new G-E units are now in full production and are ready to take on the toughest communication jobs you can give them! They are performance-engineered at Electronics Park* to withstand extremes of heat and cold as well as the severe vibration of mobile service—built to give you the clear, sharp reception you've been waiting for!

Here's an opportunity to test this new G-E equipment—an opportunity you can't afford to miss!

TO PRESENT USERS OF 30-44 MC EQUIPMENT OF ANY MAKE!

The most important single item in your entire radio communication system is the base station receiver. Step up the performance of your present 30-44 MC system by installing one of the new G-E receivers in your central station. You'll notice the difference immediately throughout your entire net. Off-channel interference will be reduced almost to the vanishing point, your signals will come through louder, clearer than ever before. And—

If the new G-E unit doesn't do a better job for you than any equipment you've ever used, General Electric will take it back at no cost to you!

*World center of electronics progress—General Electric's new "University of Industry" at Syracuse, New York.

Let the Equipment Do the Talking!

Clip and Mail this Coupon Today! (For even faster action, call the radio communication representative at the G-E office nearest you, or wire *General Electric Company, Building 1, Room 239, Electronics Park, Syracuse, New York.*

General Electric Company—Bldg. 1—Room 239J
Electronics Park, Syracuse, New York

I am interested in your Trial Offer. Send me all the facts on the new G-E 25-50 mc equipment and have your representative call on me.

NAME.....

TITLE or COMPANY.....

ADDRESS.....

CITY.....STATE.....

REMARKS.....

.....

1965's Pole Replacement Bill

will be lower

if You Use

U·S·S Creosote Oil

today

● Treating poles and crossarms today with U·S·S Creosote Oil is the surest way to hold down replacement costs in future years. There'll be years of service left in poles treated with this time-tested preservative, when untreated poles have outlived their usefulness.

That's because the penetrating power of U·S·S Creosote Oil carries protection *deep* into the wood. This adequate, effective penetration, combined with high toxicity, guards poles and crossarms against rot, decay, termites and other wood destroyers, year in and year out.

There's no variation in the good results you can obtain from U·S·S Creosote Oil . . . continuous processing in the world's largest tar distillation plant makes possible absolutely uniform quality.

For longer pole life and lower replacement costs, it will pay you to use or specify U·S·S Creosote Oil. If you'd like more information on U·S·S Creosote Oil and the extra years of service it adds to poles and arms, write us today. There's no obligation.

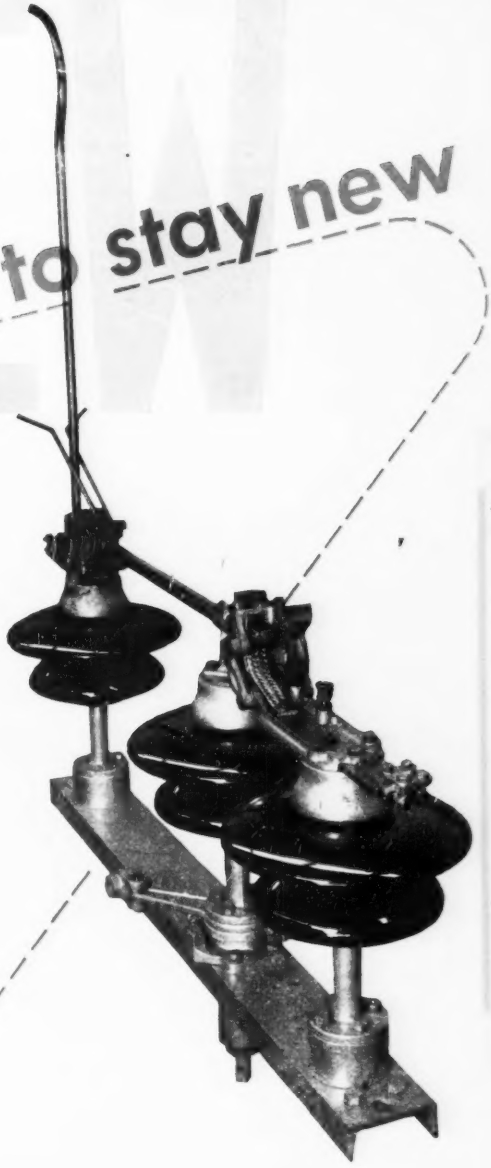
COAL CHEMICAL SALES DIVISION
United States Steel Corporation Subsidiaries
71 Broadway, New York 6, N. Y.

USS

CREOSOTE OIL

UNITED STATES STEEL

---and built to stay new



There is a time-defying ruggedness built right into these new Hi-Voltage Switches.

Proof is in the brand-new operating mechanism. It's a direct, mechanical linkage . . . uses no cams or rollers. There is little chance for wear in this simple mechanism, and certainly nothing to stick, bind or adjust.

On the contact end, stainless-steel springs maintain constant pressure on the silver-nickel contacts. A bronze sleet hood completely encloses the entire contact unit. (You find this only on Hi-Voltage Switches.) Dirt, ice and sleet cannot interfere with the permanent conductivity these multiple, line-type, silver contacts develop.

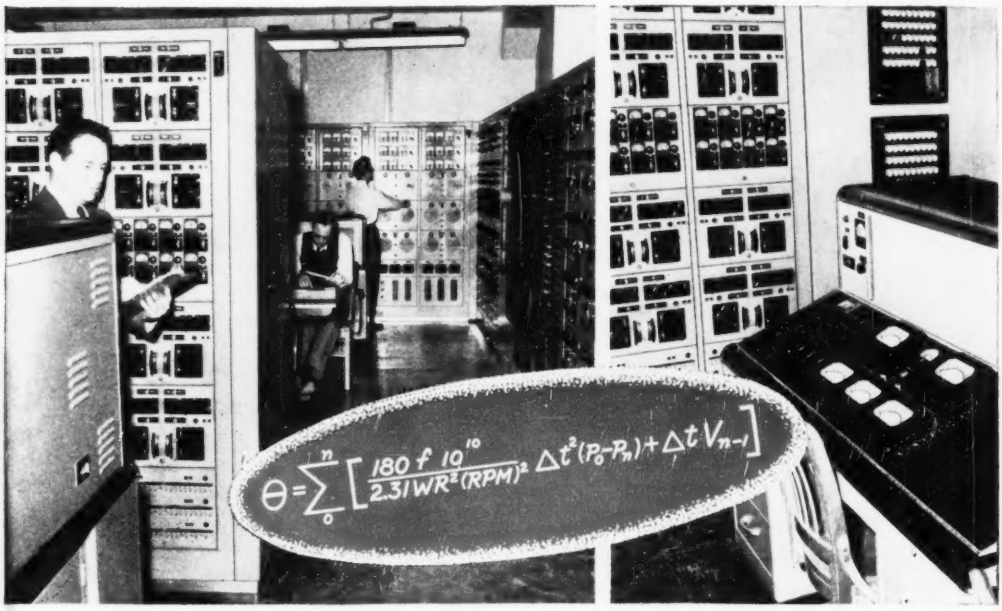
Detailed technical information about this great new model is yours for the asking. Write today and learn about the exceptional economy Hi-Voltage Switches afford *both* in installation and operation.

HI-VOLTAGE EQUIPMENT COMPANY

4000 EAST 116th STREET • CLEVELAND 5, OHIO

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



WESTINGHOUSE INSTRUMENTS
Help Solve This Equation...in Minutes!

This A-C Network Calculator, at Texas A & M College, solves complex operating and design problems such as this, in a matter of minutes or hours . . . instead of weeks or months!

Precise electrical analogies required instruments built for accuracy and *complete reliability*. Westinghouse instruments more than live up to these requirements. They also provide the co-ordinated spacesaving designs so necessary to such exacting applications.

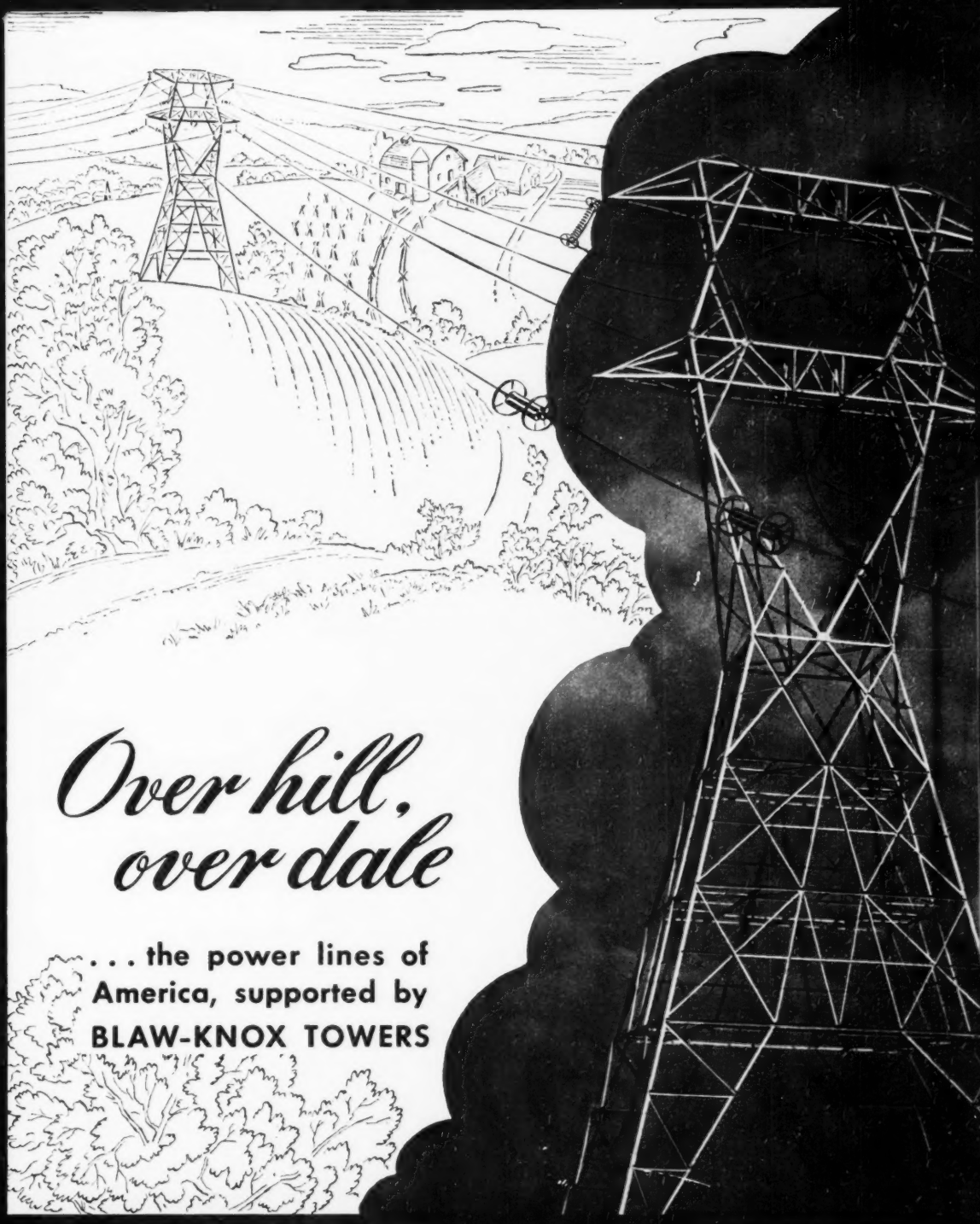
What are your electrical measuring problems? The wide scope of the Westinghouse line, and the vast experience that backs it up, provides the electrical measuring instruments to fill *your* needs exactly . . . no matter what the problem. That's why Westinghouse instruments have long been the choice of design engineers in every field of industry.

Westinghouse instrument specialists are available in the field for consultation. Call your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-40372

Westinghouse

Electrical Measuring Instruments

for Every Application



Over hill, over dale

. . . the power lines of America, supported by **BLAW-KNOX TOWERS**

BLAW-KNOX TRANSMISSION TOWERS

BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY • 2013 FARMERS BANK BLDG., PITTSBURGH, PA.

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ANSONIA

Ankoseal Control Cable

LOWER COST—YET YOU CAN...

CONTROL CABLES
Station control for Utilities
Traffic control for cities and towns
Machine control for industrial use

You really can forget all the customary causes of Control Cable trouble when you install **Ankoseal*. Its many advantages result from the new all plastic insulating and jacketing which provide the highest level of chemical inertness attainable.

As a result, your **Ankoseal* Control Cable installation will prove much more resistant over the years to flame, moisture, water and oil than the insulating materials of the cable you may be using now.

The extreme resistance to physical and chemical deterioration of **Ankoseal* Control Cable is your assurance of exceptionally long service life, so much so that in the ordinary rigors of daily service you can literally—*forget* it!

This Multiple Conductor Cable is available in a variety of standard sizes and construction. Custom-built cables can be provided for special purposes.

More detailed information, especially as to how **Ankoseal* Control Cable can improve your particular operation, will gladly be sent to any cost-conscious utility executive. Write us.

*Reg. U. S. Pat. Off.

THE ANSONIA ELECTRICAL COMPANY

SUBSIDIARY OF NOMA ELECTRIC CORPORATION

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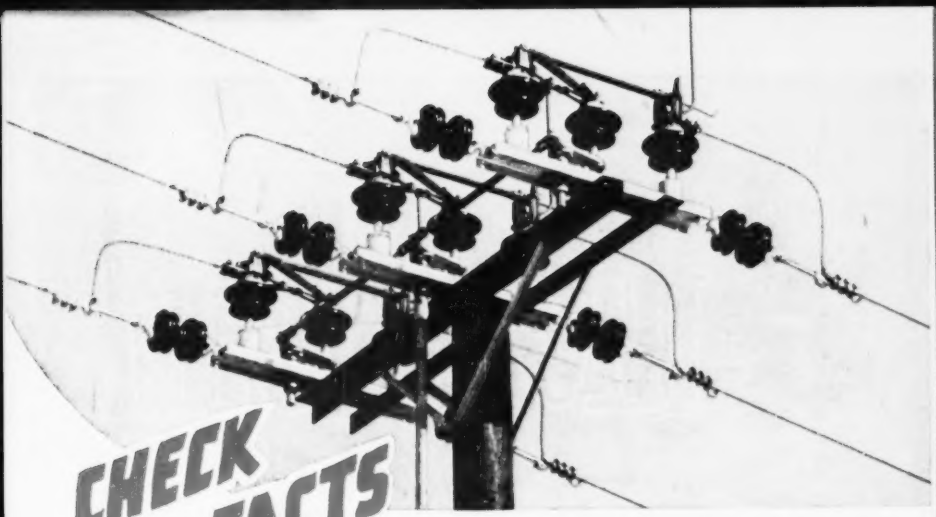


CHECK the FACTS

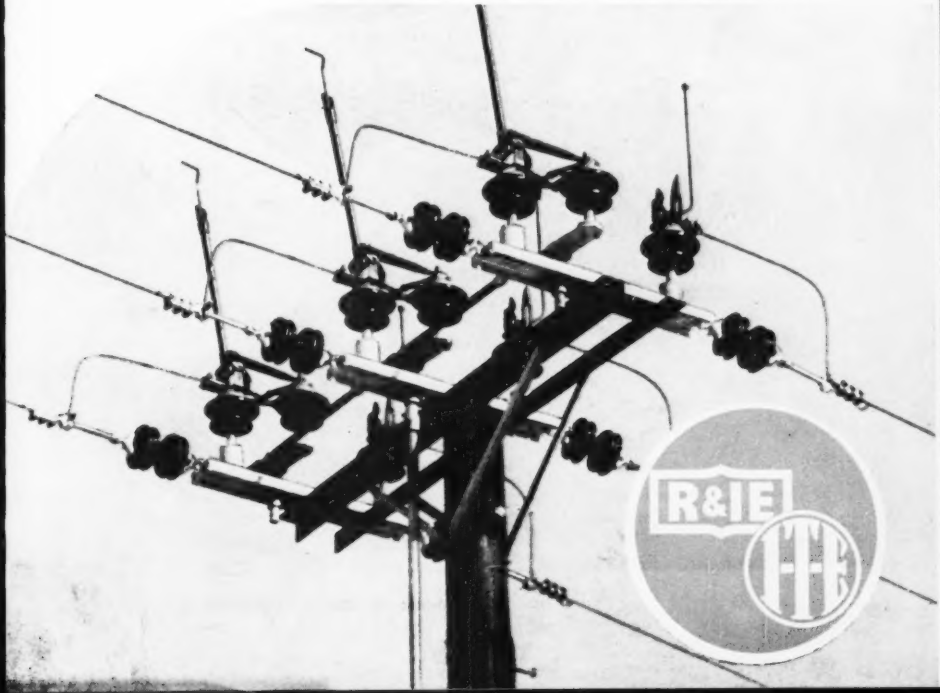
on the fundamental features

of GROUP OPERATED AIR-SWITCHES

1. HI-PRESSURE CONTACTS—today the standard of comparison. Pressure does the cleaning, and makes a dependable electrical and mechanical contact connection.
2. BLADE OPERATING PARTS—simple lever action makes and releases contact in closed blade position only—and further movement closes or opens blade without contact drag, thus decreasing operating effort.
3. BLADE HINGE—equipped with a properly designed, bolted flex connection which further decreases operating effort—and provides a reliable electrical connection.
4. BEARING—greaseless, weather-sealed, ball-bearing type—again decreasing operating effort.
5. INTERCONNECTING RODS—strong, fully adjustable—connected to switch cranks with Everdur pins.
6. TERMINAL—clamp type, with four half-inch bolts.

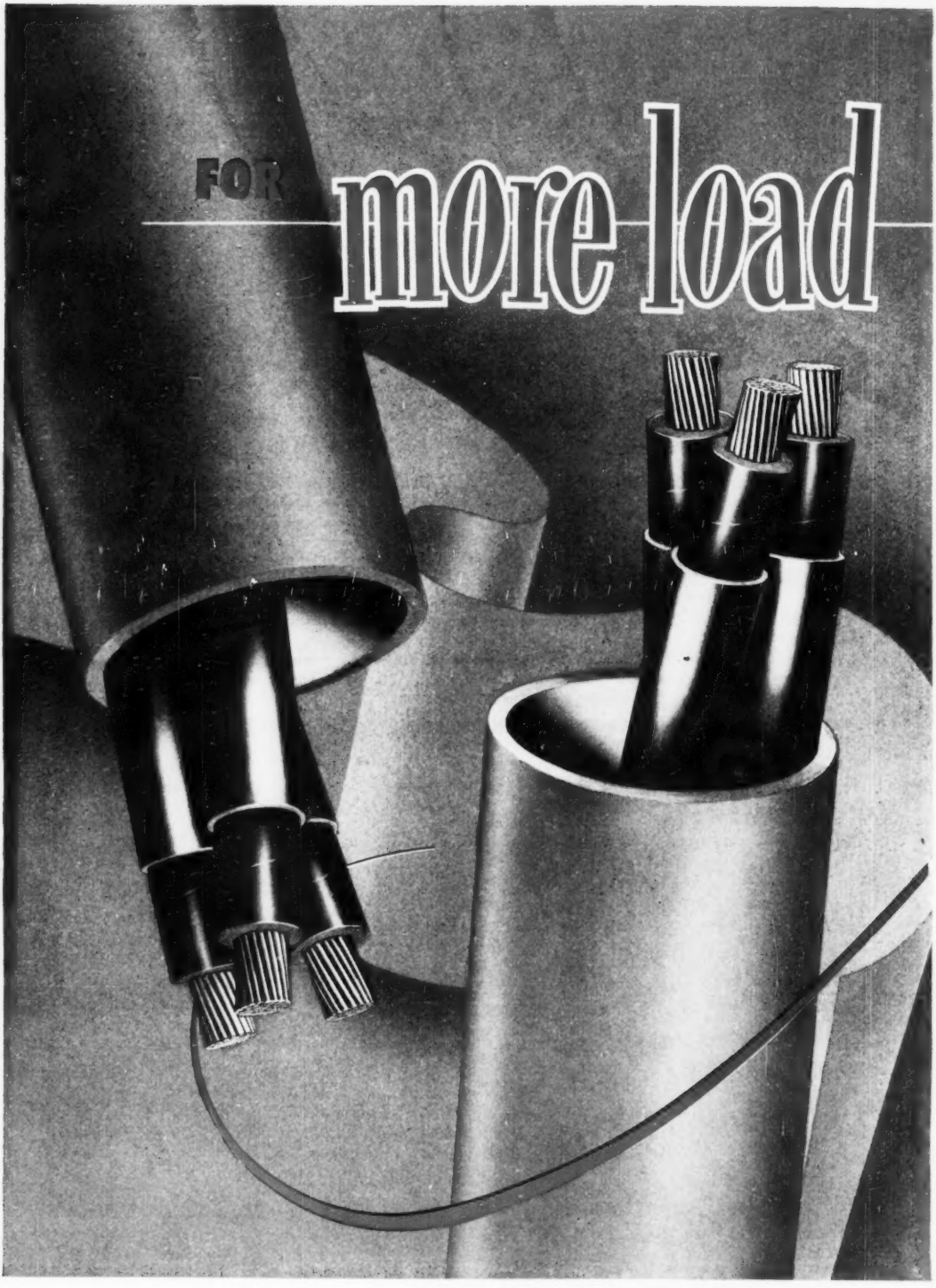
RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO



The Check List

- CONDUCTOR SUPPORTS CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC RECLOSING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES


FOR
more load

USE TYPE ML MULTI-LEAD PAPER INSULATED CABLES

● For cable users who desire an increase in the possibilities of emergency cable ratings, with no radical departure from present-day "solid" cable construction, we offer Type ML (Multi-Lead) Cables. This construction consists of three orthodox single-conductor paper-and-lead cables stranded together, without fillers and without any over-all binders, to provide for three-phase distribution.

ADVANTAGES

The use of Type ML Cable attacks the problem of cable overload and of severe load fluctuation from several different angles:

1. The loose assembly of conductors permits them to compensate for expansion in length by *radial* rather than longitudinal movement.
2. The individual lead sheaths, because of their smaller diameter, bend more readily, with less strain, and less danger of cracking due to lead fatigue.
3. In Type ML Cables, as compared to three-conductor cables, the diameters of the lead sheaths are reduced in greater proportion than their thickness. Thus, they are better able to withstand internal pressure without rupture.

HANDLES MORE LOAD — SAFELY

In actual use, Type ML Cable shows a number of advantages: (1) it is possible to operate it at maximum standard temperature ratings or, in emergencies, above these limits without danger of sheath failure; (2) an easier training problem in small manholes; (3) greater ease in making "L" taps and single-phase load diversions; (4) elimination of trifurcating joints for use of single-conductor potheads; and (5) simplicity of installation.

Write for complete engineering information on Type ML Cables and how they can handle *more load* without danger of sheath rupture.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

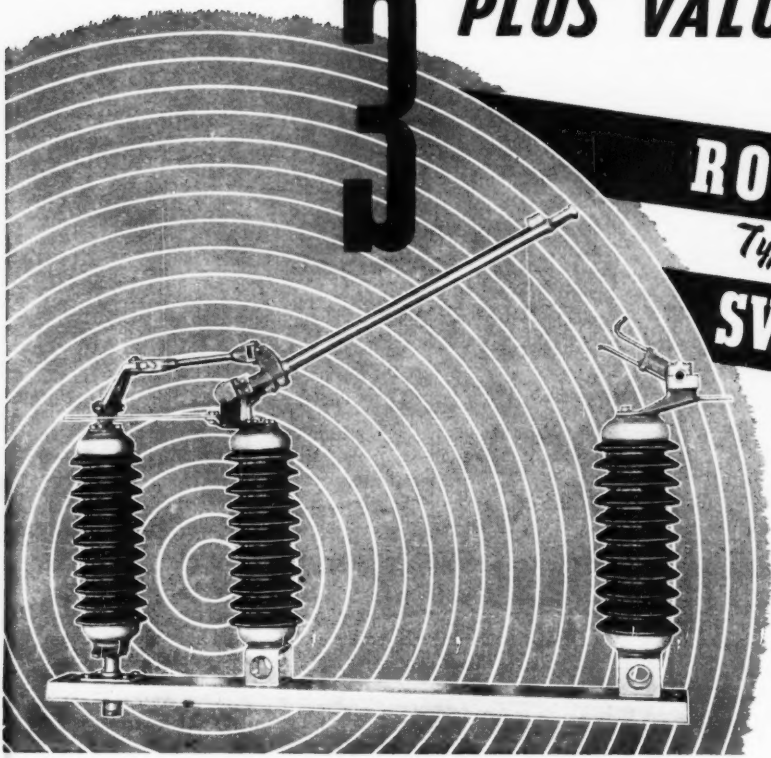
Paper Insulated Cable

USS

UNITED STATES STEEL

3 PLUS VALUES OF

ROYAL Type VVL SWITCHES



1 SIMPLICITY OF DESIGN

*2 HIGH PRESSURE POINT CONTACTS

3 SEALED BALL BEARINGS

* HIGH PRESSURE POINT CONTACTS

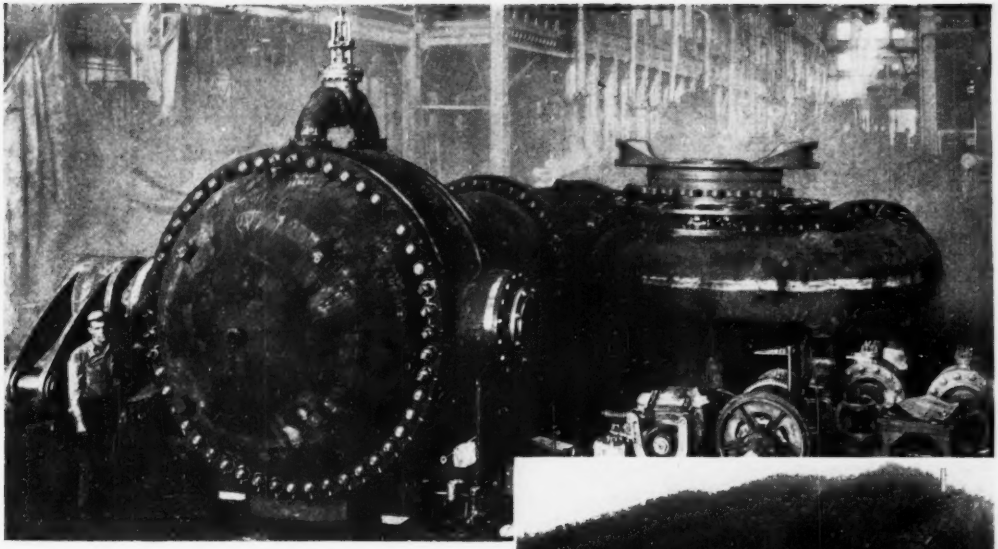
Both front and rear contacts of Royal's type VVL switch utilize the now popularly accepted high pressure point contacts, of a patented design which has been in production at Royal since 1937. Contact pressure is developed by expanding the contact rods across the long axis of the blade cam. This permits opening and closing of the switch by a simple direct lift of the blade, without any supplementary mechanisms. The same type of contact is used at the hinge. Royal pioneered the elimination of braid shunts at the hinge end. This is a feature which assures service continuity even after years of operation in highly contaminated atmospheres. The front contact is held in position to receive the blade by two beryllium-copper motor springs. This switch is extremely simple, easy to operate and easy to maintain.

The ROYAL Display Wagon will demonstrate this switch at your door—Watch for it!

Write for Royal's new Catalog No. 11 of switches, power connectors, clamps, fittings and construction accessories.

35 YEARS
A Part of the Arsenal of
AMERICAN POWER PRODUCTION

Royal ELECTRIC MANUFACTURING COMPANY
INCORPORATED
1122 EAST 87th STREET *Chicago 19, Ill.*
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices



HIGH-HEAD REACTION TYPE TURBINES

The Newport News built 60,000 horsepower Francis type turbine of the Nantahala Hydro-Electric development operates under a maximum static head of 1,008 feet at a speed of 450 revolutions per minute. It is one of the highest-head reaction type turbines installed in the United States and one of the highest-powered extremely high-head reaction turbines in the world. A field test by the Gibson method gave a maximum efficiency of 93.7 per cent when operating under a net head of 925 feet. No pressure regulator is included in the installation.

Contracts received by Newport News for turbines of all types and heads aggregate a rated output of 6,283,000 horsepower. At Nantahala, and in many of the world's other great power developments, the engineering efficiency and workmanship of these units have been proven by actual performance.

NEWPORT NEWS

SHIPBUILDING AND DRY DOCK COMPANY

NEWPORT NEWS • VIRGINIA

"During a power phase failure not one motor out of over 100 failed to clear itself... When power was restored we were ready to operate without a moment's loss in production"

"We believe you will be interested to know how well your Fusetron dual-element fuses protected our electric motors when we experienced a phase failure on our power circuit this past week.

"We have considerable obsolete 2 phase equipment in our plant but we are eliminating it as we go along. To protect these motors until the change-over, we had two choices: expensive thermal relays or Fusetron fuses. Naturally, we chose Fusetron fuses. From that time on, which is over two years, we have not lost one motor. Last week when the power phase failure occurred, not one motor failed to clear itself.

"Having over a hundred motors in the plant, we had a hatfull of blown fuses to replace but, when the power was restored, we were ready to operate without a moment's loss in production.

"Our past experience with Fusetron fuses proves that they will not blow needlessly — provided, of course, that the fuse rating is matched to the motor.

"We are using Fusetron fuses on our new machinery along with thermal protectors to prevent the machine operators from blocking the relay switches in the on position.

"Fusetron fuses are an absolute must on all electrical equipment in our plant."

Victor J. Kryst, *Maintenance Foreman,*
F. H. HILL COMPANY, INC.,
Cleveland, Ohio

Our Experience Proves

Facts About FUSETRON Dual-Element FUSES

The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.

(FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.)

Fusetron DUAL-ELEMENT Fuses

Provide

10 Point Protection

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Get all the Facts - Send the Coupon Now!

FUSETRON
TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION
BUSS

FUSETRON Dual-Element Fuses Give ALL-PURPOSE PROTECTION

One needless shutdown — or one lost motor — or one destroyed switch or panel — may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse.

Don't risk such losses — protect yourself by installing a FUSETRON dual-element fuse in every set of fuse clips throughout the entire electrical system.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division McGraw Electric Co.)

Please send me complete facts about FUSETRON dual-element Fuses.

Name _____

Title _____

Company _____

Address _____

City & Zone _____ *State* _____ 849

"15 Years Service... Only 5 Hours Down-Time"

THAT'S THE RECORD of our Allis-Chalmers Rocking Contact Voltage Regulators," says the Chief Engineer of a large industrial laundry.

"And our regulation is good! The old regulator wouldn't hold within 50 volts on our varying loads. We had trouble all the time with under-voltage relays kicking out. With our Allis-Chalmers Regulator, variations are ironed out in a fraction of a second — and our equipment keeps running."

Low Maintenance, Accuracy, Instant Response and *Dependability* — these are the results of Rocking Contact design. There are no vibrating contacts and no gliding friction to hinder accuracy and response. No complex adjustments to make — *simplicity* means years of trouble-free service for you!

Rocking Contact Voltage Regulators are available for both a-c and d-c generators of any size and speed, for either parallel operation or unit control. Call your nearby A-C office, or write direct.

A-2754

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

OTHER ALLIS-CHALMERS SPECIAL CONTROL

SYNCHRO-OPERATOR — Automatically synchronizes alternating current generators, tie lines, synchronous condensers, etc.

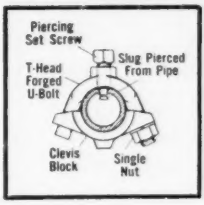
D.C. POSITIONER — Operates from power plant d-c bus, used for remote indication, control, order telegraph, etc.

REGULEX CONTROL — Used where the features of a rotating type regulator are desired.

Regulex is an Allis-Chalmers trademark.

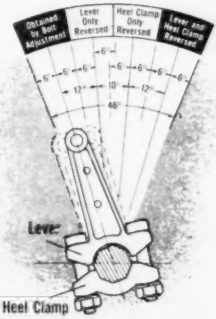
DELTA-STAR *Group Operated Switches*
PLUS DELTA-STAR *Operating Mechanisms*

Design features, exclusive with Delta-Star switch mechanisms, assure easy and rapid switch synchronization which will remain in adjustment permanently. Levers, clevises and other fittings cannot slip regardless how hard or how frequently switches may be operated. You will appreciate the operating ease and low installation cost of Delta-Star outdoor switches equipped with these efficient mechanisms. Twenty years of satisfactory service, under all climatic and atmospheric conditions, attests to their ruggedness and wide acceptance by the industry.



1. **Levers are adjustable to the exact angle desired throughout 360-degrees around the bearing—can be installed or removed without disturbing rotating insulator. (See lower right illustration.)**
2. **Clamp type, non-slip forged-U-bolt fittings with self-piercing set screws eliminate threading and drilling of pipe—available in a wide variety of units to make up complete mechanisms.**
3. **Self-piercing set screws actually punch out the pipe to provide a positive key—adjustment will not drift. (See upper right illustration.)**
4. **Switch and control bearings have greaseless non-rusting ball bearings—insure free operation under all weather conditions.**
5. **Universal adjustment—permits quick and precise synchronization of group operated switches.**
6. **Adaptable to any switch position or arrangement with standard mechanism parts.**

For complete details consult our nearest representative or ask for Publication No. 4903.



Adjustment can be repeated eight times around the bearing.

DELTA-STAR ELECTRIC COMPANY

MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE — 140 Cedar St., New York 6, N. Y.

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Tampa, Fla.
Washington, D. C.
Honolulu, Hawaii

CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 15, Canada

NEW HIGHER POWER

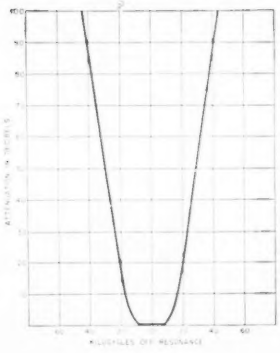
The new RCA FLEETFONE is a mobile communication equipment designed to meet the special requirements of the 30-50 mc band. The FLEETFONE provides not only for the longer distances common on 30-50 mc and the higher power usually required, but also introduces a new high degree of compactness and installation convenience.

New "Sandwich" assembly

Compact "Sandwich" Construction. Within this ultra-compact housing is contained the complete transmitter, receiver, and power supply. The single-package "Sandwich" construction takes the difficulty out of installation. Simply bolt the base to the desired surface in the desired position. Insert the chassis. Fasten the cover. Connect the cables. It's as simple as that.

Mounting Versatility. The FLEETFONE is designed for mounting in practically any location or position. It may be mounted on its bottom, side, or attached to a vertical surface. This is especially important to operators of large fleets of vehicles of various types. The FLEETFONE is just as much at home in an automobile, a light pick-up, or a ten-ton trailer-truck.

30 or 60 Watts Output. In order to meet the coverage requirements of your particular area, the FLEETFONE gives you a choice of either 30 or 60 watts of transmitter output. In both cases, it's the same size, single-package unit.



"CANYON-CURVE" SELECTIVITY

6- or 12-Volt Operation. The 6-volt FLEETFONE is standard equipment for general, mobile application. In addition, many mobile vehicles, such as trucks, fire engines, etc. use a 12-volt battery. In these vehicles the 12-volt FLEETFONE (30 watts) eliminates the need for power-wasting, voltage dropping resistors, or the necessity to impose too heavy a drain on half of the battery.

Extra Features. "Canyon-Curve" Selectivity protects you against interference from stations on neighboring channels. The exclusive "Transducer Modulator Control" maintains a constant modulation level whether you whisper or shout into the microphone. High receiver sensitivity assures reliable reception at extreme distances and in the roughest terrain.

GET THE COMPLETE FACTS:

DEPARTMENT 31H
RCA ENGINEERING PRODUCTS
CAMDEN, NEW JERSEY

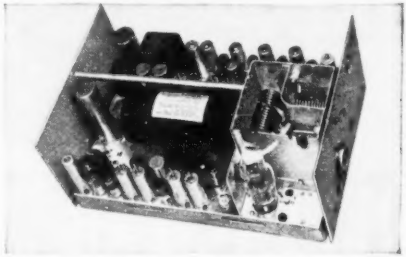
Gentlemen: Send me the free brochure telling all about the All-New RCA FLEETFONE.

Name_____

Address_____

City_____

State_____



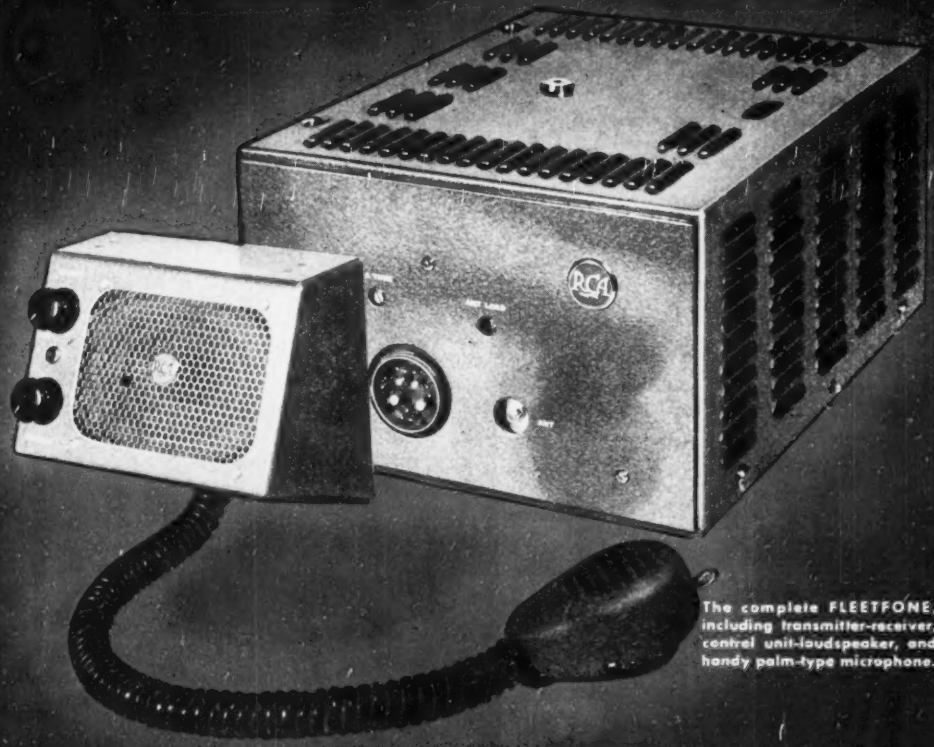
Inside view of the 30-watt FLEETFONE showing transmitter portion (foreground) dynamotor and receiver (background).

WITH SMALLER SIZE-

The RCA FLEETFONE

30-50 Mc

MOBILE 2-WAY RADIO



The complete FLEETFONE, including transmitter-receiver, control unit-loudspeaker, and handy palm-type microphone.

MOBILE COMMUNICATIONS SECTION

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: R.C.A. VICTOR Company Limited, Montreal

the specialist does it better!

As proved by more than 1,000,000 Kvar in over 4,000 capacitor installations, for over a decade on utility systems throughout the world.

CORNELL-DUBILIER CAPACITORS

PRODUCTS OF SPECIALISTS IN POWER-FACTOR IMPROVEMENT

A national average of over a decade of trouble-free utility service proves conclusively that, in the *power-factor improvement field*, the specialist does it better. That the experience of these utilities will be *your* experience is not a mere paper promise, nor a laboratory hope. For C-D capacitors have stood the test of time in the field—the toughest test of all. For Consistently Dependable results in the field, specify C-D capacitors. Your inquiries are invited.

Cornell-Dubilier Electric Corporation, Dept. D-89, South Plainfield, New Jersey. Other plants in New Bedford, Worcester and Brookline, Mass.; Providence, R. I.; Indianapolis, Ind. and Cleveland, Ohio.

Follow the leaders

Demand dependable C-D Capacitors—built by capacitor specialists.

1,980 Kvar, 4,160 volt, WYE, 3 phase, 60 cycle, station-type C-D equipment.

CORNELL-DUBILIER world's largest manufacturer of capacitors

1916 1949 Reg. U. S. Pat. Off.

C-D Best by Field Test!

IRV-O-SLOT

The slot insulation *Bound* to last longer

The big news about Irv-O-Slot is good news for motor manufacturers. This famous slot insulation, with all its excellent electrical characteristics, benefits by a new, specially-developed Irvington binder that doesn't harden or lose its tack; that provides full assurance against migration . . . against delamination . . . against oozing out under heat. Thus Irv-O-Slot provides far greater service life, and far longer shelf life as well; and the thickness of the finished insulation is held within exact tolerance limits.

Test Data: **The normal delamination test for slot insulation is 96 hours at 125°C. Laboratory tests show Irv-O-Slot withstands 150°C. for over 288 hours, retaining full bond without migration.**

Irv-O-Slot is available in straight-cut or seamless bias varnished cambric bonded to either fish paper or rag stock. Write for generous test samples, further information.

New IRVINGTON Binder provides an insulation that

Won't Migrate!
Won't Delaminate!

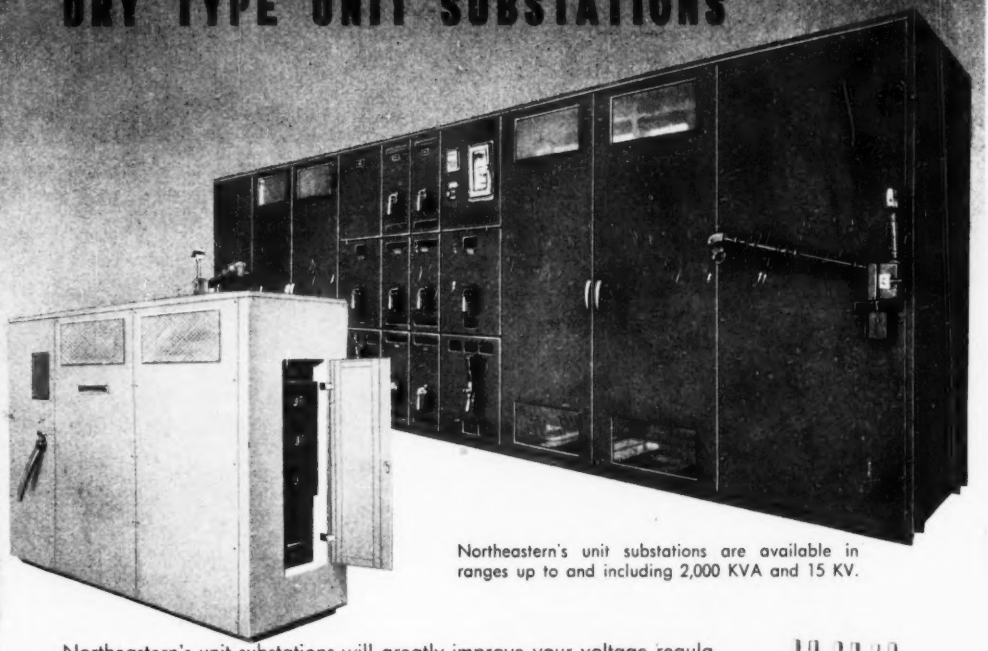
"Look to Irvington **for Continued Leadership in Insulation"**

IRVINGTON *Varnish & Insulator Company*

Irvington 11, New Jersey

Authorized distributors in Atlanta; Baltimore; Berkeley; Bluefield, W. Va.; Boston; Charlotte; Chicago; Cleveland; Dallas; Denver; Detroit; Los Angeles; Milwaukee; Minneapolis; New Hartford, N.Y.; New Orleans; Philadelphia; Pittsburgh; Portland, Ore.; St. Louis; Seattle; Hamilton, Ont., Canada.

Modernize
YOUR POWER DISTRIBUTION
WITH NORTHEASTERN'S DRY TYPE UNIT SUBSTATIONS



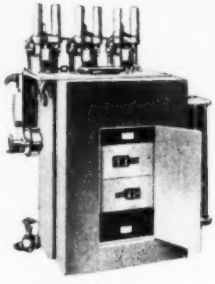
Northeastern's unit substations are available in ranges up to and including 2,000 KVA and 15 KV.

Northeastern's unit substations will greatly improve your voltage regulation and simplify cable problems. They are attractive in appearance, may be located conveniently close to the load. No vaults, fireproofing or any special building construction necessary.

One efficient piece of equipment contains your high tension protection — your transformer — your low voltage distribution.

The installed cost of Northeastern dry type unit substations is lower.

Northeastern's Engineers are ready to help you with your modernization plans. Call Northeastern, there is no obligation on your part.



Write today for Northeastern's new technical bulletin No. 110.

NORTHEASTERN ENGINEERING, INC.

MANCHESTER, NEW HAMPSHIRE

THE *American* COACH & BODY COMPANY

MAIN OFFICE AND PLANT — 9503 WOODLAND AVE., CLEVELAND 4, OHIO
CALIFORNIA DIVISION — 432 FIFTH STREET, OAKLAND 7, CALIFORNIA

SALES OFFICES: INSURANCE EXCHANGE BLDG. DES MOINES 9, IA. · 207 LAKE STREET MONROE, N. Y. · HEALEY BLDG. ATLANTA, GA.

DISTRIBUTORS: BAKER EQUIPMENT ENGINEERING CO. SUMMIT & NORFOLK STS. RICHMOND 11, VA. · EQUIPMENT SERVICE, INC. 1 WAWARME AVE. HARTFORD 1, CONN.

ACB and

American B-4

CREW COMPARTMENT-LINE CONSTRUCTION BODY

Tools and Crew

ARRIVE ON THE JOB *Ready for Work*

The American B-4 carries 7 men comfortably... four in the body crew compartment and three in the cab. Plenty of leg and head room without knee hugging.

Warm in winter, cool in summer, the crew compartment has full body width, good visibility and ventilation. Shelves and racks take care of gloves, matches, lunch boxes, iced water cask and dozens of other items necessary to a crew. One of the most popular features is a collapsible table for convenience of the men.

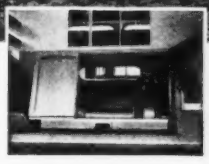
Equally important, the B-4 has space for all of the diversified equipment needed for line work. Roomy, locked compartments on each side of body carry small items. Inside, the big body has ample space and 12 swivel material hooks.

The derrick tunnel permits easy loading and unloading of derrick at shoulder height. Ladder racks are adjustable. Extended platform protects men when loading or unloading material, and gives additional body floor capacity.

The B-4 body can be mounted on any conventional or C.O.E. type of chassis. There are three body lengths . . . 132", 156" and 168". CA dimensions range from 83" to 113".

Complete information on the universally used B-4 is yours for the asking.

For those who prefer a line body without crew compartment . . . *American* offers the DPL.



The tilting crew seat on the B-4 gives the driver a clear view of winch, another safety feature.

You can do a *lot*

with a little GOLD SEAL TAPE

Here's a tape you can count on in emergencies. But what makes Gold Seal the lasting favorite of linemen and electricians is that it *goes further* . . . on *any* job.

Gold Seal Tape does not dry out, peel or ravel. It tears evenly, quickly. Production is laboratory controlled to assure plenty of "tack" in the friction compound, a base cloth of high dielectric strength.

There's more tape value in every roll of Gold Seal because there's no waste. It grips tight, forms a firmer, longer-lasting bond, winter or summer. Try it on your next job. See if you don't agree that it's the best buy in tape. In single rolls and handy ten-roll cartons. Each roll is cellophane-wrapped — *factory-fresh*. Jenkins Bros. (Rubber Division), 80 White St., New York 13, N. Y.

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet both ASTM and Federal Specifications.

JENKINS *Gold Seal* *Tape*

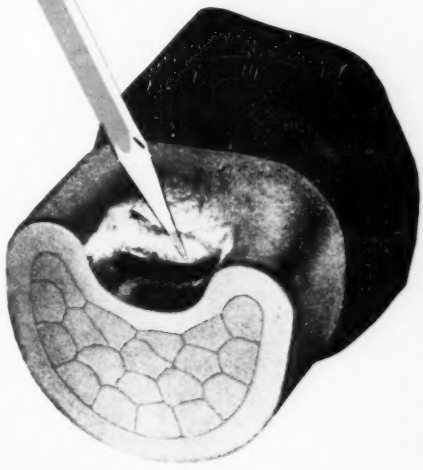
FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

Here's why

BURNDY HYDENT CONNECTORS

are superior mechanically... electrically

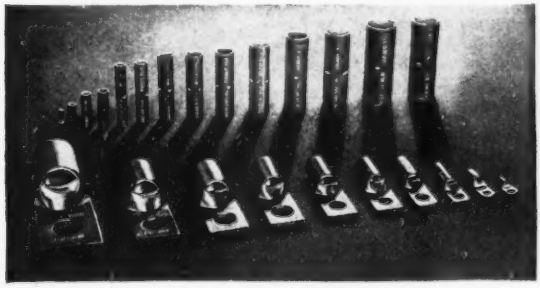


No art tricks . . . this is a cross section photo of a typical HYDENT connection.

Note how the conductor and connector have been compressed into an almost solid mass under high pressure by the Burndy HYPRESS or HYTOOL.

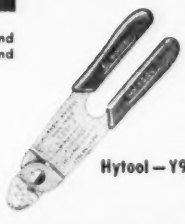
And there's no trick to cutting costs the modern HYDENT way. Just insert conductor, indent with the HYTOOL, and, *presto*, the job is done.

HYDENT connectors are available in all types for conductors #22 through 2000 Mcm . . . all one-piece, pure copper construction, heavily tin-plated. Catalog Y46 gives the complete story. Send for your copy today.



Hydent Connectors range from the smallest sizes used for control, instrument and electronic equipment wiring to the largest cable sizes required in industrial and utility power applications.

Burndy Hytools and Hypresses indent Hydent connectors onto all conductors from #22 to 2000 Mcm.



Hytool — Y9M

Hypress — Y34-A

Connect with

BURNDY

New York 54, N. Y.

WESTERN BRANCH: Vernon 11, California • CANADA: Canadian Line Materials, Ltd., Toronto 13

In Automotive Voltage Regulators, too . . .

MALLORY CONTACTS

Won't "Overcharge" You

Regulating voltages is no small thing in a modern car. With a dashboard looking like the panel of a B-29, voltage regulators have to be good to prevent overcharge, and avoid undercharging, too!

That's why Mallory Contacts are the choice. The contact material must stand 20 breaks a second. But Mallory Contacts take it for a normal life of 2000 hours—or 7,200,000 contact breaks. These precision-made contacts have the required toughness—the resistance to wear and erosion—that rapid-action contact applications demand. For example, in tungsten contacts, Mallory exercises the most rigid processing control that combats erosion to produce a rugged, resistant interlocking grain structure. The same type of precision manufacture is behind Mallory silver-alloy and platinum-alloy contacts.

What's Your Problem?

You'll find Mallory tungsten, silver-alloy or platinum-alloy contacts on duty in such widely diverse applications as refrigerators, street lighting units, lift trucks. Mallory has designed so many types that there's a standard Mallory contact for almost any problem that could arise. But if your problem cannot be solved by an existing Mallory contact—Mallory engineers are equipped to make one to handle it.

In Canada, made and sold by Johnson, Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

For all kinds of contact materials and service, Mallory is your most dependable and experienced source.

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.

MALLORY

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Capacitors	Rectifiers
Contacts	Switches
Controls	Vibrators

Power Supplies

Resistance Welding Materials

What makes a good tape GOOD?

To manufacture good serviceable tape certain standards must be met. A short cut on any one point would result in a sub-standard product. Accurate production strictly adheres to the 5 quality points below—at all times.

1 Fine strong straight woven cotton fabric base.

2 High quality, clean rubbers scientifically blended to form a stable, tacky, adhesive impregnating compound.

3 Impregnation of the sheeting with the compound by steel calendar rolls operating at different peripheral (friction) speeds. That's where friction tape gets its name. Tape made by less costly methods isn't genuine friction tape.

4 Slitting to desired width on specially designed machines to assure clean, non-raveling edges.

5 Proper packaging in handy protective cartons and tins to keep tape clean.

That's the way ACCURATE Friction Tape is made. It's the reason every foot is of consistently high quality. Friction or rubber, use ACCURATE Tapes for best results because all are made to highest standards for your protection. There is an ACCURATE distributor near you. Ask for his name today. Just write Accurate Mfg. Company, Garfield, New Jersey.

MEMO FOR CONTRACTORS!

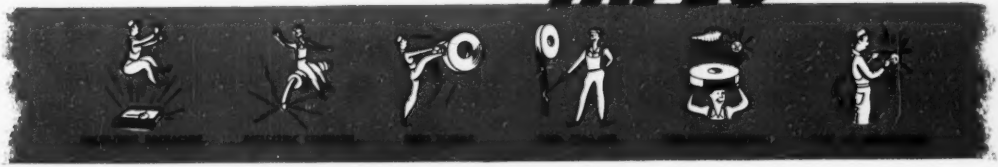
THE HANDY 10-ROLL PROTECTIVE CONTAINER

Keeps tape clean and fresh on the job. It's a good idea to have a few always on hand in your field stockroom, ready for use when you need it.

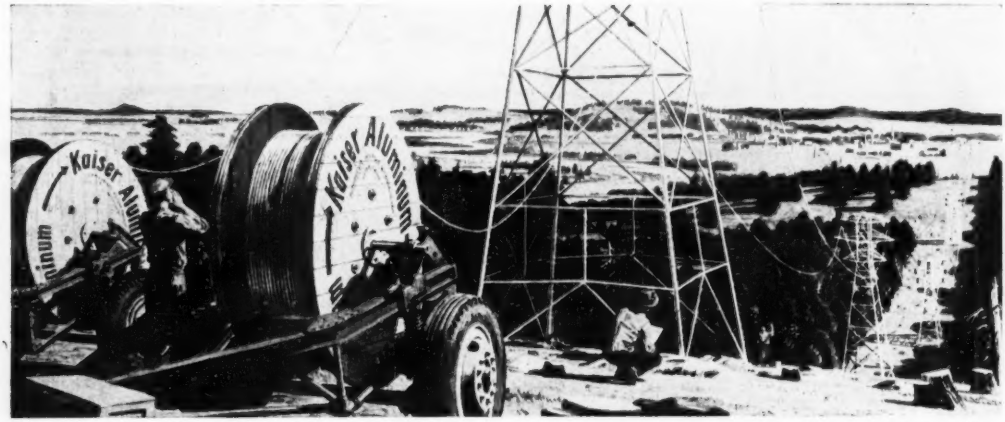
ACCURATE

25 YEARS MAKING TAPES EXCLUSIVELY

TAPES

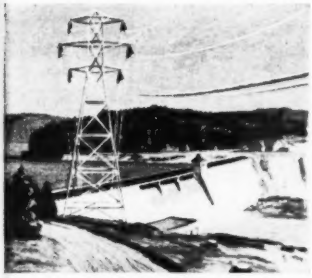


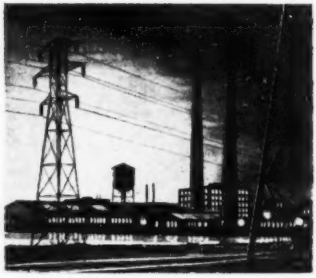
A major new source of Cable...



RIGHT NOW, Kaiser Aluminum Cable and ACSR is being delivered to public and private power enterprises—serving industry and farms—from coast to coast. Produced at Permanente Metals' strategically located Newark, Ohio plant—which has an annual capacity of more than 100 million pounds—this top-quality electrical conductor is available to you in a complete range of standard sizes and standard strandings.

brings more power to America!





KAISER ALUMINUM CABLE is tested by the most modern equipment in the country, including a new 100,000 pound, 50-foot tensile machine designed and built especially for Permanente Metals. Thus you are assured unsurpassed quality, at competitive prices. To take advantage of *some early delivery schedules which are still open,* act now. Inquire at any Permanente Products' sales office—in major cities from coast to coast.

Permanente Metals

PRODUCER OF

Kaiser Aluminum Cable

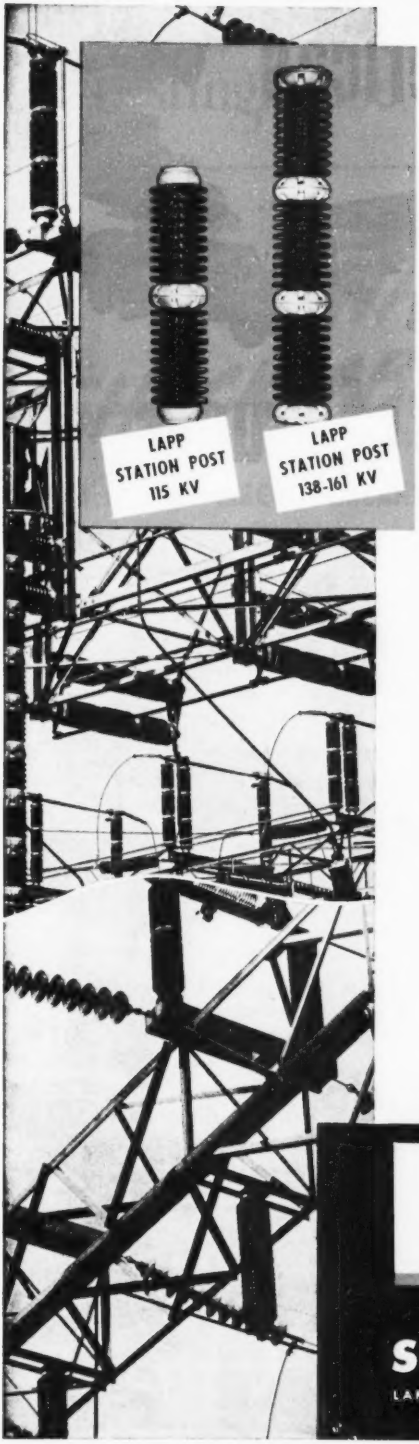
Completely Controlled for Quality

Permanente Metals' integrated operation completely controls the quality of Kaiser Aluminum Cable—from the processing of bauxite to finished cable.

Such quality control . . . plus a record for service that is unsurpassed . . . explains why thousands of manufacturers in many fields consistently use Kaiser Aluminum.

SOLD BY PERMANENTE PRODUCTS COMPANY, KAISER BLDG., OAKLAND 12, CALIFORNIA . . . WITH OFFICES IN:
Atlanta • Boston • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Houston • Indianapolis • Kansas City • Los Angeles
Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Portland, Ore. • Seattle • Spokane • St. Louis • Wichita

Also available through General Electric Supply Corporation, Westinghouse Electric Supply Company, and Line Material Company.

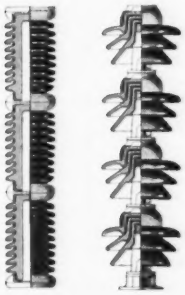


LOOK BETTER...
PERFORM BETTER...
LAST BETTER...

LAPP STATION POSTS

AT 115-161 KV

In the 17 years since the introduction of the Lapp Post design, more and more companies have switched their construction standards to Lapp Line Post and Station Post insulators. It's not just that these modern insulators look up-to-date. They perform better and last longer—cause fewer outages—require less maintenance. Countless operating records prove the claims for Lapp Post insulators—better performance under arcover and under dirt conditions, elimination of puncture and cracking, greater rigidity in any mounting position.



COMPARE

Sketched at left are a Lapp Station Post and a conventional pin-type switch insulator—both for service at 138-161 Kv. Post construction calls for *six* cemented joints, metal caps *externally* attached—large-area low-intensity compression loading on porcelain. The pin-type has *twelve* nested porcelain parts, all small-area high-intensity loading depending on tension strength of porcelain—its weakest characteristic. You'll save trouble and improve operating records when you switch to Lapp Posts—for all voltages up to 161 Kv.

Lapp
STATION POSTS

LAPP INSULATOR CO., INC. • LE ROY, N.Y., U.S.A.

Choose from America's

most complete line of trucks

for these 4 reasons

1 **International Trucks are specialized** for the job. International builds America's most complete line of trucks. It offers 22 basic models, 1,000 truck combinations ranging in gross vehicle weights from 4,400 to 90,000 pounds. It also offers 13 truck engines (gasoline, diesel, butane) as well as specialized units and parts, to satisfy individual hauling requirements. An International sales engineer who knows your business in terms of trucks helps you analyze your own hauling needs and select the right International Trucks to meet them.

2 **For the 17th straight year** International Trucks lead in heavy-duty sales. The country's most exacting truck buyers are the men who buy trucks of 16,001 pounds GVW and over. Their vote of confidence in Internationals is based on truck value —the same truck value found in every International . . . light, medium, and heavy-duty.

3 **More than half of all International Trucks** ever built—in 42 years—are still at work. International has been building rugged trucks uncompromised by passenger car design or construction since 1907. International Trucks are built to last—and they do.

4 **International Trucks are backed** by America's largest exclusive truck service organization. 4,700 Dealers and 170 Company-owned Branches offer complete International Truck service wherever you drive a truck. Precision-engineered replacement parts, factory-rebuilt exchange units, and factory-trained mechanics are as close as your telephone. For the right truck to solve your hauling problems, see your nearest International Dealer or Branch.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

INTERNATIONAL INTERNATIONAL **TRUCKS**

INTERNATIONAL HARVESTER COMPANY • CHICAGO

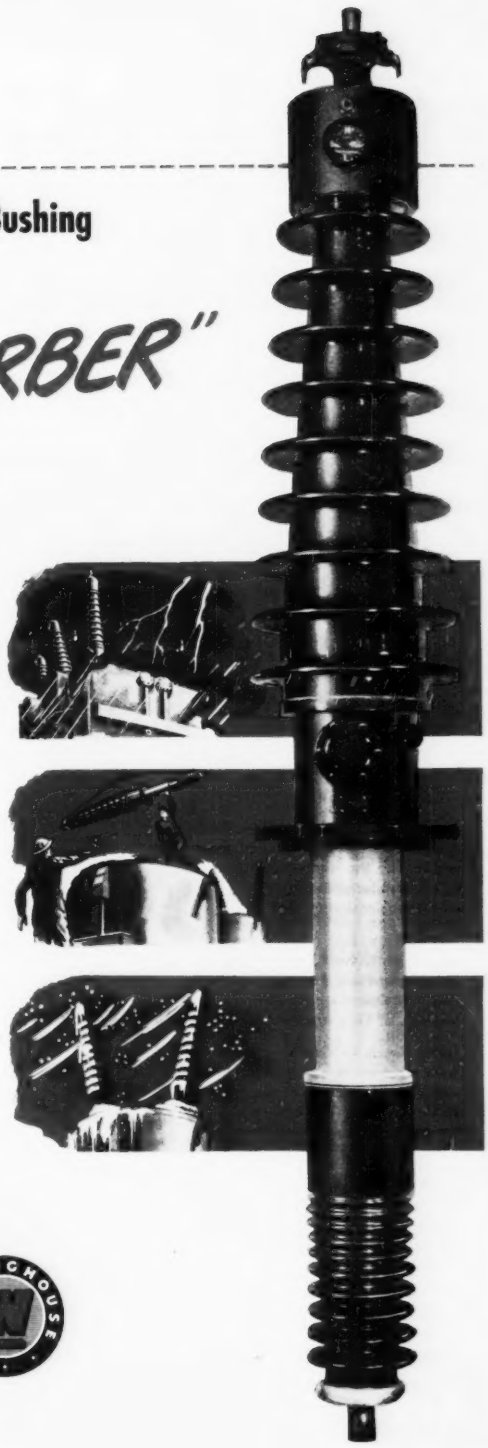
YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Type "O" Condenser Bushing

3 WAY "SHOCK ABSORBER"

FOR POWER CIRCUIT BREAKERS AND POWER TRANSFORMERS



ELECTRICALLY... Insulation of the highest quality is provided in the condenser, which is completely impregnated with degassed oil, hermetically-sealed and cushioned with dry nitrogen to insure continued low internal loss and radio-influence voltage.

MECHANICALLY ... Springs in the cap keep pressure on the gaskets at all times. The porcelains are one piece. Bushing construction is strong mechanically.

THERMALLY ... Because of its excellent design—electrically and mechanically—the Type "O" Bushing is not affected by heat or cold. Internal losses do not increase appreciably over the temperature ranges encountered in transformers or circuit breakers.

Greater electrical, mechanical and thermal strength add up to increased safety for your system. All the facts on the Type "O" Bushing are available from your nearby Westinghouse representative. Ask him for Booklet B-3462, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. Also ask for information about circuit breakers and transformers equipped with Type "O" Bushings. J-60711

Westinghouse

POWER CIRCUIT BREAKERS
POWER TRANSFORMERS

KEARNEY
TRIPOMATIC
HEAVY DUTY
FUSE CUTOUT

For High Interrupting Capacity on To-day's Power Lines

FEATURES:

1. **Reinforced housing of highest quality wet-process glazed porcelain and the non-warping door of molded bakelite provide a heat and shock-resisting unit.**
2. **Silver-plated upper contact serves as a latch to hold the door in the closed position. The resilient corrosion resistant spring absorbs the impacts of high interrupting duty.**
3. **Stirrup latch on the non-indicating cutout prevents opening of door and insures against damage from cable expulsion or drawn-out arcs on extreme short-circuits.**
4. **Cartridge head with silver-plated contact studs assures excellent conductivity through four point pressure contacts with upper spring.**

IN THE DAYS when heavily overloaded circuits were still the exception and not the rule, the Kearney Heavy Duty Trip O-Matic non-indicating cutout was designed to meet the requirements of a large power company whose over-taxed circuits demanded heavy-duty protection. This cutout has served the company dependably with maximum protection for over nine years.

And now when overloaded circuits are an everyday problem and with the outlook for more and more power demands in the future, the Kearney HD cutout is available for all power companies. Its nine-year in-service record of electrical and mechanical dependability in protecting heavily loaded circuits subject to high short-circuit surges is your assurance of dependable performance.

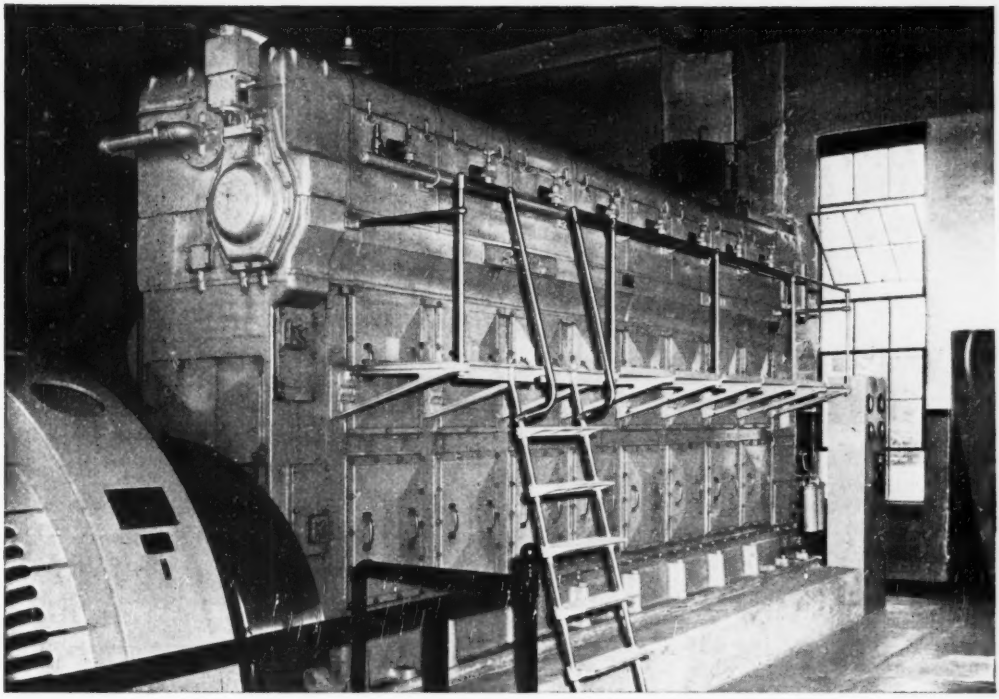
Illustration shows the Kearney Trip-O-Matic Heavy Duty Fuse Cutout, Catalog No. 12143-10, 50 amperes, 5000 volts. Interrupting current rating 5000 amperes at 5000 volts; 8000 amperes at 2500 volts.

For additional information on Kearney HD cutouts, write for Catalog Sheet 2-11.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Ave. • St. Louis 10, Mo.
Canadian Plant: Guelph, Ontario

Always Specify JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. *for the Job . . .*

Better Construction – *SAFER* Maintenance



THERE'LL BE SOME CHANGES MADE

Many communities and industries, located near a source of natural gas, are getting lower cost electric power with dual fuel Superior Diesel Engines. The dual fuel feature offered by Superior enables them to burn low cost gas in the summer and switch to oil in winter when gas is in short supply. Superior . . . the first Diesel with push-button control of fuel selection permits you to change from oil to gas, or gas to oil instantly . . . with just a flick of a finger.

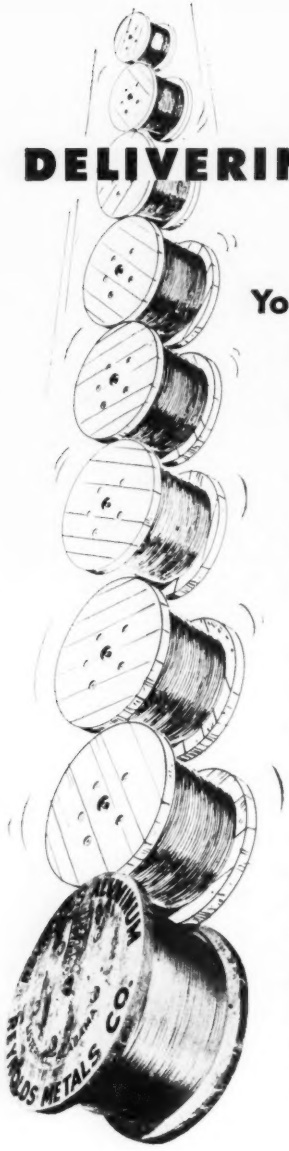
There are many other Superior operating economies that are due to the following features: Conservative Ratings • Fuel Economy • Precision Bearings • Heavy Rigid Crankshafts • Strong Bases and Cylinder Blocks • Proved Roller Chain Camshaft Drive • Oil Cooled Pistons. One of our field engineers will be glad to show you the advantages of these features, or we will be glad to send you a fully illustrated booklet.

THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL SUPPLY COMPANY NSCO

Superior DIESEL

DELIVERING ACSR PDQ



You Can Specify Reynolds Aluminum Cable Assured of Early Delivery—and Immediate Savings . . . !

Demand dictated another major supplier in the aluminum cable field. That's why Reynolds is in the business—to make it easier for you to capitalize on the basic advantages of this product.

Low first cost is just one of many savings Reynolds ACSR offers you. High conductivity and strength, less sag, longer spans and easier, faster erection are all advantages of ACSR that will enable you to extend new lines and "heavy-up" existing ones at a lower cost.

It is definitely to your advantage to consider aluminum —then consult Reynolds for your cable needs. For prices and complete product information call the Reynolds field office listed under "Aluminum" in your classified telephone directory. Or write direct to address below.

NEW TECHNICAL MANUAL ON ACSR

Engineers will welcome this new manual. Contains full technical data on ACSR: Sag tension charts, staking tables and stringing-sag tables plus data on line design and erection. Free when requested by letter.

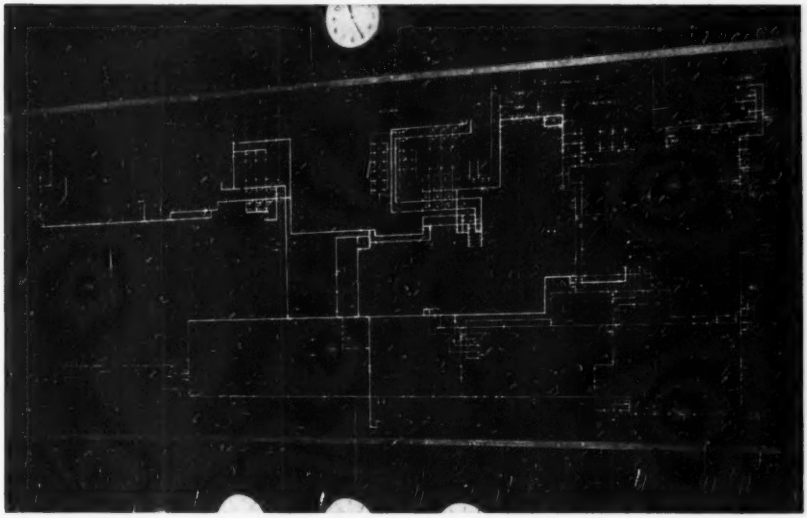
REYNOLDS METALS

REYNOLDS METAL COMPANY

LOUISVILLE 1, KENTUCKY

CONSIDER ALUMINUM — CONSULT REYNOLDS — THE COMPLETE ALUMINUM SERVICE

This circuit diagram is made up of individual panels of Graphic Lamicoid. Permanent clarity and durability is assured by the resistance of Lamicoid to wear and abuse, moisture, and corrosive vapors.



Graphic Lamicoid

for clarity, durability and economy

The circuit diagram above is attractive and easy to read—and it will stay that way for years. Upkeep cost is low, too, because it's made of Graphic Lamicoid.

Graphic Lamicoid is a rigid, tough, and moisture resistant panel, with printed matter permanently laminated in the thermosetting plastic sheet. Special age-resisting resins make a clear protective surface over the printed matter—a surface that resists wear and chipping and won't check or cloud. Graphic Lamicoid (with regular printed material) is especially economical where many panels with identical markings are desired; yet panels with different markings can be produced at minimum cost by the use of Van Dyke reproductions, as in the circuit diagram illustrated.

Graphic Lamicoid can be drilled, tapped, punched or sawed—so it's easy to install. It can be cleaned in seconds with a damp cloth—so it's no trouble in upkeep. It resists moisture, oils, corrosive vapors and temperature extremes—so it lasts and lasts.

Features like these make Graphic Lamicoid an ideal material for economical production of clear and durable signs, dials, nameplates, wiring diagrams and plotting boards. Engraving and Translucent types of Lamicoid are also available. For further information, contact our nearest sales office or fabricator.

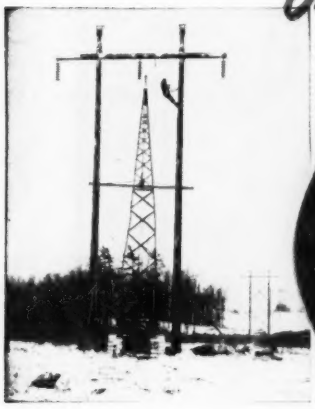
MICA Insulator COMPANY

Schenectady 1, New York

Offices in Principal Cities

Your PORCELAIN PRODUCTS' Suspension Insulator...

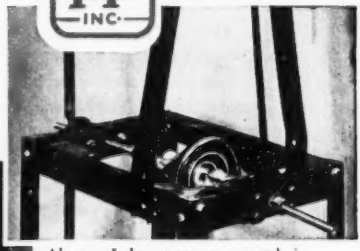
the best Power Salesman on Your Payroll

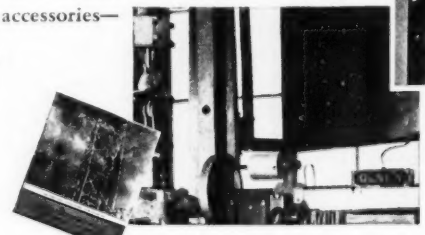


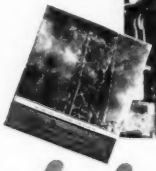
You sell power when your lines stay up. One "weak link" in your insulator chain can black out whole communities, resulting in unsatisfactory customer relationships, the cost of which cannot be computed, in addition to the cost of repairs and the loss of revenue. PORCELAIN PRODUCTS' Suspension Insulators keep selling for you because they give continuous, trouble-free performance. They're compression glazed for added toughness, and designed to withstand unusual strain of wind and ice loads. Built to rigid manufacturing standards, like those illustrated, assure perfect performance in service. Next power job, specify PORCELAIN PRODUCTS, and see what a "power salesman" you've hired. For other PORCELAIN PRODUCTS' High Voltage Insulators and accessories—

PINTYPES, CUTOUTS SPOOLS, STRAINS, CLEVISES, RACKS, WIREHOLDERS

Write for Your Copy of Catalog 10-A







Above—Laboratory measured impact tests verify the fact that your P.P. Suspension Insulators can *"take it"*.

Left—C—Combined mechanical electrical strength test proves the stamina of Porcelain Products Suspension Insulators.

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

THE FUTURE HOLDS GREAT PROMISE

Neither chance nor mere good fortune has brought this nation the finest telephone service in the world. The service Americans enjoy in such abundance is directly the product of their own imagination, enterprise and common sense.

The people of America have put billions of dollars of their savings into building their telephone system. They have learned more and more ways to use the telephone to advantage, and have continuously encouraged invention and initiative to find new paths toward new horizons.

They have made the rendering of telephone service a public trust; at the same time, they have given the telephone companies, under regulation, the freedom and resources they must have to do their job as well as possible.

In this climate of freedom and responsibility, the Bell System has provided service of steadily increasing value to more and more people. Our policy, often stated, is to give the best possible service at the lowest cost consistent with financial safety and fair treatment of employees. We are organized as we are in order to carry that policy out.

Bell Telephone Laboratories lead the world in improving communication devices and techniques.

Western Electric Company provides the Bell operating companies with telephone equipment of the highest quality at reasonable prices, and can always be counted on in emergencies to deliver the goods whenever and wherever needed.

The operating telephone companies and the parent company work together so that improvements in one place may spread quickly to others. Because all units of the System have the same service goals, great benefits flow to the public.

Similarly, the financial good health of the Bell System over a period of many years has been to the advantage of the public no less than the stockholders and employees.

It is equally essential and in the public interest that telephone rates and earnings now and in the future be adequate to continue to pay good wages, protect the billions of dollars of savings invested in the System, and attract the new capital needed to meet the service opportunities and responsibilities ahead.

There is a tremendous amount of work to be done in the near future and the System's technical and human resources to do it have never been better. Our physical equipment is the best in history, though still heavily loaded, and we have many new and improved facilities to incorporate in the plant. Employees are competent and courteous. The long-standing Bell System policy of making promotions from the ranks assures the continuing vigor of the organization.

With these assets, with the traditional spirit of service to get the message through, and with confidence that the American people understand the need for maintaining on a sound financial basis the essential public services performed by the Bell System, we look forward to providing a service better and more valuable in the future than at any time in the past. We pledge our utmost efforts to that end.

LEROY A. WILSON, *President*
American Telephone and Telegraph Company.
(From the 1948 Annual Report.)

BELL TELEPHONE LABORATORIES EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

Nicopress

The Tool and the Sleeve

that are made to work together

together
they make the perfect splice

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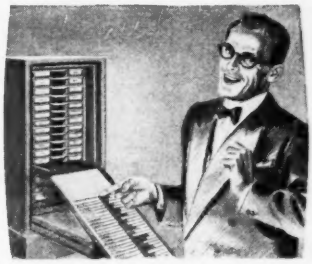
"So you're getting less work per PAYROLL DOLLAR

. . . Here's how WE met that problem

OUR OPERATING COSTS INCREASED because of higher wages...shorter hours ...employee welfare activities...higher taxes. Convinced that simplified methods could help realize full worker potential, we started a survey of our personnel records and procedures.

WORK SIMPLIFICATION WAS APPLIED by Remington Rand Systems Specialists, who *simplified* our personnel forms, operating procedures and administrative methods—then installed them for us—without getting in our way!—then trained our people in their use.



INFORMATION IS NOW ORGANIZED in a Kardex Visible System for rapid administrative review of facts about each employee. Application, work history, attendance record, merit rating data, seniority status – are all summarized in ONE compact visible system.

RECORDS ARE FULLY PROTECTED against fire-loss in Safe-Kardex, with all supporting papers housed in *laboratory-tested* insulated Safe-Files. If fire strikes, all vital personnel data will be available for prompt and efficient resumption of business activities.

NEW EDITION—COPY FREE ON REQUEST

"PERSONNEL ADMINISTRATION —Records and Procedures"

The 88 pages of this valuable brochure are crammed with practical information, new methods, new ideas for Personnel Departments in all types of business. Ask for your free copy today. Call the nearest Remington Rand office for Book No. X 521B or write on your business letterhead to Systems Division, Room 1110, 315 Fourth Avenue, New York 10.

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Remington Rand THE FIRST NAME IN BUSINESS SYSTEMS

Let these 10 Cottrell savings cut your recovery costs!

WESTERN PRECIPITATION is the organization that pioneered the first commercial application of the now-famous Cottrell Electrical Precipitator. And its unique Cottrell advancements, developed through more than 38 years of leadership, assure you the most modern in Cottrell equipment from Western Precipitation Corporation. Cottrell advantages include . . .

1. **LOWEST DRAFT LOSS:** Cottrell draft loss is only a few tenths of an inch w.g.—practically negligible!
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5. **LONGEST LIFE:** Early Cottrell installations are still operating after 38 years of continuous heavy duty service.
6. **HIGHEST EFFICIENCY:** Cottrell recovery efficiency approaches 100%, if desired.
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8. **ANY CAPACITY:** Cottrells handle a few c.f.m. —or millions—with equal ease!
9. **MAXIMUM FLEXIBILITY:** Cottrells can be installed with vertical or horizontal flow to fit space requirements.
10. **LOWEST OVERALL COST:** Over a period of years, Cottrells cost less per year of service . . . less per ton recovered.

In 31 Countries Throughout the World . . .

there are more than 3,000 Cottrell installations maintaining performance records unapproached by any other equipment for the control of dust, fog, fume, fly ash and mist.

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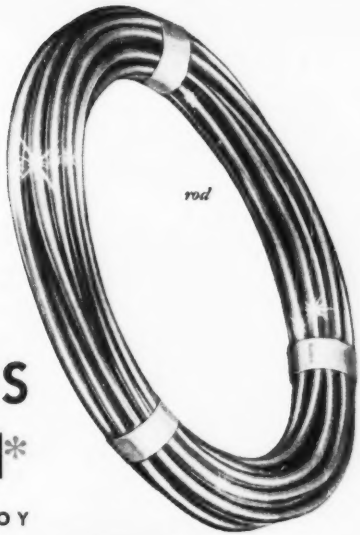
Whether yours is an application where COTTRELL *electrostatic* recovery is best . . . or where MULTICLONE *mechanical* recovery is best . . . or where a *combination* of the two gives maximum economy and efficiency . . . you get an unbiased recommendation from Western Precipitation Corporation. This organization is the home of *both* COTTRELL and MULTICLONE recovery equipment and can design, engineer and install either type separately—or *both* types working in combination, under one responsibility, with one overall guarantee, from one widely-experienced organization. Write, wire, or phone our nearest office.

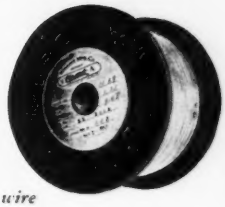
Send for descriptive literature!

NOW SELLING...

COTTRELL Precipitators · MULTICLONE Collectors · TURBULAIRE Spray Dryers

...in all parts of the U.S.A. and foreign countries.





HOSKINS
Chromel*
RESISTANCE ALLOY

. . . basic element of electrical heating

Here's the stuff directly responsible for today's widespread use of electric heat. It's Hoskins CHROMEL . . . the *original* nickel-chromium resistance alloy that *first* made electrical heating practical way back in 1906. Ductile, durable, hard-to-burn out, it possesses close-to-constant "hot" resistance between 700° and 2000° F. . . . delivers full-rated power throughout its long and useful life. And it's produced to a uniform tolerance of resistance as wire, ribbon, or rod to meet the requirements of a wide range of domestic and industrial applications. So if you're concerned with electric heat . . . from a load-building point of view, as a manufacturer of heating devices, or as a user of electric heat in your manufacturing processes . . . you'll do well to get acquainted with Hoskins CHROMEL. Complete technical information is contained in our Catalog M-1 . . . want a copy?

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Heating Element Alloys ★ Heat Resistant Alloys ★ Thermocouple Alloys ★ Spark Plug Electrode Wire ★ Special Alloys of Nickel ★ Electric Heat Treating and Laboratory Furnaces

Chromel®

ORANGEBURG
FIBRE CONDUIT

STANDARD
Installed with Concrete

NOCRETE
Installed without Concrete

Cables "Walled In" For Lifetime Service
UNDERGROUND

The ELECTRICAL ENGINEER realizes that the push of a button floods the home with light or sends power pulsing into the industrial machine *only when all's well with the underground cables.* ORANGEBURG CONDUIT helps keep these *life-lines long-lived.*

The *impermeable* walls and tight taper sleeve joints of ORANGEBURG CONDUIT protect cables *permanently* from corrosion . . . just as its smoother bore and low coefficient friction safeguard it *from* Cable Sheath Abrasion, *from* Pulling Tensions, *with* Cable Movement . . . facts proved by ORANGEBURG'S 50-year record underground.

Above ground, the news is also good . . . because ORANGEBURG CONDUIT combines unique strength and toughness with light weight, ease of handling, transportation and installation. These features together with its permanent resistance to corrosive ground waters and chemical wastes, provide a product that is low in *initial* and *maintenance* cost.

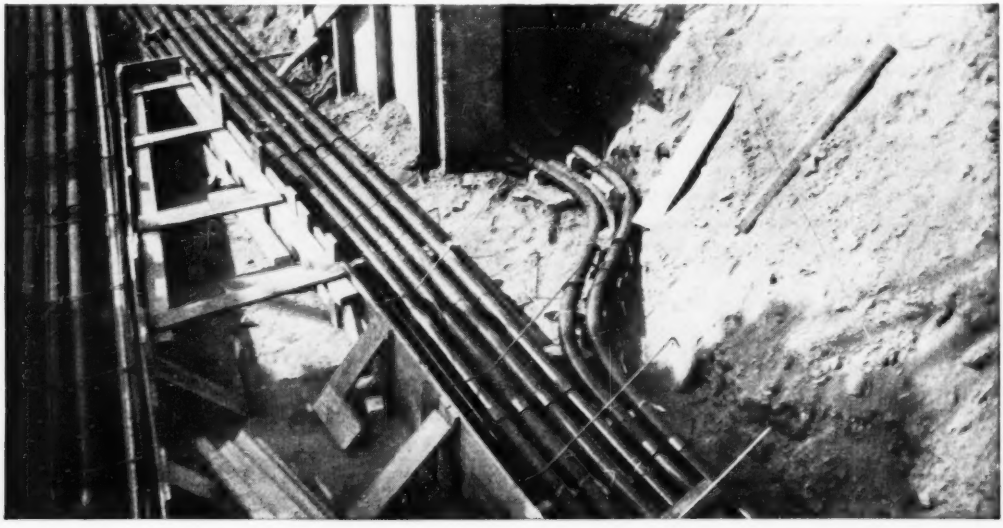
For more complete information write today for ORANGEBURG Catalog No. 50. Keep it for ready reference in your files.

ORANGEBURG STANDARD — For installation with concrete encasement. ORANGEBURG NOCRETE — For installation without concrete encasement.

Distributors · Graybar Electric Co., Inc.
General Electric Supply Corp.

Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

Illustration below is ORANGEBURG STANDARD *for installation with concrete encasement.*



Sangamo Watthour Meters

Good for Accuracy . . .

The modern oilless, noiseless, non-corrosive bearing system and rigid dovetailing of elements contribute to *sustained* accuracy. In actual customer service since 1940, a large group of J Meters in an 8-year test showed only five-hundredths of 1% change in accuracy from that at the time of installation!

Good for Revenue . . .

Overload compensation and other inherent overload characteristics will accurately measure *present* and *future* loads up to 400% of meter rating without loss of revenue.

Good for Economy . . .

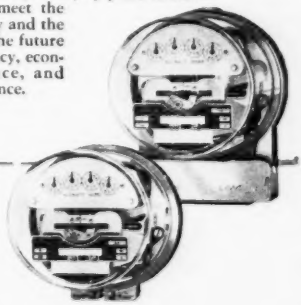
J Meters are built of corrosion-resistant materials and have full temperature compensation for cost-saving outdoor installations. All parts are easily accessible for inexpensive calibration, inspection, and replacements.

Good for Troublefree Service . . .

Sangamo J Meters have unusual freedom from electrical failure due to high insulation levels. Troublefree operation is inherent in the oilless bearing system. Millions of J Meters in use since 1940 have proved this fact.

* * *

Sangamo J Meters have *proved*, by years of service, their ability to meet the requirements of today and the anticipated loads of the future with sustained accuracy, economy of maintenance, and troublefree performance.



50TH ANNIVERSARY SANGAMO 1899 - 1949

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

How to lift a dollar's morale...

IF there's anything that makes a man feel "down in the dumps" it's the thought that he's not as good as he used to be. So it's easy to imagine what a dollar must feel like when it reflects on the good old days.

There are billions of dollars floating around today . . . but what with inflation and all, they aren't happy.

When it comes to buying cable, however, you can step up the morale of your dollars, because there's nothing that will give a cable dollar a lift like being invested in Kerite.

Makes a dollar go farther . . . last longer . . . buy more years of service . . . than if it were to go for something less permanent.

Why, we know of Kerite cable that's been in service for more than fifty years and is still going strong! And you'll be glad to know the Kerite that makes that cable endure is the same Kerite used in making present-day Kerite insulation.

We have interviewed several dollars lately. They tell us that it's a real relief to be clearing through our bank. Makes them feel important to buy cable with such long life and such low cost per year. The Kerite Co., 30 Church St., New York 7.

Kerite Insulation—Your Cable's Best Life Insurance

KERITE CABLE

Big Jobs to Do

WE RECENTLY received a communication from an electric co-op manager which we feel should be repeated. He said in part, "Our feeling is that the profit power companies are an extremely important part of our way of life, but that the co-operatives are supplementing them by serving many, many consumers whom they could not serve profitably." This is probably the feeling of a majority of the hard working and efficient managers of the co-ops.

Assuming this statement to be true, where is the friction between the private utilities and the electric co-op? It would appear that friction does not really exist except in perhaps a minor way. That which there is can usually be traced to a few loud-spoken individuals with an axe to grind.

When Idaho Power Co purchased the Malheur Co-operative, one might have thought that a crime had been committed from reading certain press reports. Actually the co-op had received power at the low rate of 7.7 mills per kwhr. The deficit of this co-op is said to have been over $100,000, while its total power purchases from Idaho Power Co throughout the existence of the contract were less than $70,000. Even with free power, this co-operative could not exist. It is also understood that the REA advised the sale of this property.

If the facts are traced down, refusal of power companies to negotiate with co-ops is practically unheard of. Similarly, charges of sale of power by utilities to co-ops at excessive cost are refuted by the low average cost of about 9 mills per kwhr in 1948. The demands for generating equipment have more often come from outside than from the co-ops themselves. Certainly power can always be supplied more cheaply from a large system than from a small generating unit. Apparently with such ideas in mind, our co-op manager states further that, "both the big companies and the co-operatives have big jobs to do, and each is very important to the other . . . working together we can best serve all of the people."

We are not criticizing the co-operatives here. Nor are we implying that utilities are always right in their dealings with co-ops. Our objective is to show that if the facts are known, good faith generally prevails on both sides.

The co-op managers and the utility managers are honest, upright Americans earning a living as you and I. Whether the co-op buys the utility, as is being done by the Continental Divide Electric Co-operative, or vice-versa, as in the case of the Idaho Power Co, fair dealing is the rule.

It would appear that the needs of the future would be most adequately served if the utilities sharpened their pencils in arriving at the electric co-op contracts and the co-op managers cast a wary eye at utopian plans for super-co-ops and their own generating plants.

Public Information Dept. Still Needed

REPETITION of editorial copy is not ELECTRICAL WORLD'S policy. But upon occasion it seems to be appropriate. Almost a year ago we said, "Now is the time to plan for next year's program in terms of a Public Information Department."

In this editorial appearing in the Sept 25, 1948, issue, we suggested a five point proposal for a department to handle public information locally. The proposal included:

1. A public information executive reporting directly to the president with a title of vice-president and equivalent stature necessary to work on problems national in scope.
2. A budget adequate to support expanded activities and personnel additions.
3. Adequate dissemination of information to employees will require—
   a. an employee magazine
   b. training for employee interpretation of information for the public
   c. use of bulletin boards
   d. employee meetings
   e. attitude surveys
4. Program for dissemination of information to the community will require an organization to provide:
   a. programs for local groups
   b. cooperation with other organizations
   c. contact with radio and press
   d. news releases, special articles and publications
   e. institutional advertising
   f. opinion surveys

We commend this editorial to you for re-reading.

Liquid Fuels from Solid

SOMETHING worth watching by the electric power industry is the progress of processes to derive gasoline, heating, and diesel oil from oil shale and from coal. That the status has improved to a stage where the conversion or extraction is approaching economic practicability can be inferred from a paper by W. C. Schroeder of the U. S. Bureau of Mines at the recent ASME sessions in San Francisco.

As for oil from coal, he estimated that it can be produced at costs ranging from 9 to 12¢ per gal. Plant investments would probably be such as to add 5 to 6¢ per gal for fixed charges. The resulting 14 to 18¢ as a source cost is not wildly out of line with present production cost from welled oil. If, as, and when the latter really begins to get scarce and costly, the demand for coal production for fuel oil purposes will increase and it is likely that the coal mined will command a higher price for any end use.

Nor is the equally promising prospect of gasoline and fuel oils from the oil shales likely to eliminate the appeal of coal as a source. Schroeder estimates the production cost would be 8.4¢ per gal. His estimate of an investment of $4,000 to $5,000 per bbl per day looks like an overall at-the-plant cost of 11.4¢ per gal. Shale may thus be the first to be developed on a mass scale, but it undoubtedly would be followed by cultivation of coal as a competitive origin.

The duration of adequacy of domestic supplies of natural petroleum is "less than a decade"; he amplifies this assertion by saying that within that period "shortages of domestic petroleum can appear that would grow rapidly."

Employees Can Be Capitalists

Employee stock purchase plans have created many a headache. The industry contains a goodly number of employees who were burnt in 1929. But new conditions call for another try. A sound employee stock purchase plan is needed in every utility and industrial concern. This is one obvious approach to the overall problem of selling corporate securities.

The broad problem was adequately covered by Floyd Carlisle Jr in a recent article appearing in the *Fortnightly*. A partially satisfactory solution is being tried by Pacific Gas & Electric Co. It is offering a total of 100,000 shares of 5% redeemable first preferred stock of $25 par value. The limit is 100 shares per employee.

PG&E's plan to sell preferred stock to employees is the safe way. Certainly preferred stock will not vary in price like common. It also has a fixed dividend to offset effect of a price decline.

The term "capitalistic system" is best understood by those who think they have a share in it. Utility management can show further leadership by getting more stock purchase plans in operation and such programs might well include some common stock.

Buried Cable

The reduction in service interruptions to 4.25 per 100 mile-years is good news to the utility industry. It is equally important to the customers. Such is the record for buried cable installed by the Public Service Company of Northern Illinois as reported in this and the July 30 issue of ELECTRICAL WORLD.

An advance in the art of underground construction to the point of its costing only from one and one-half to two times the equivalent of an overhead line is important. PSNI is to be congratulated for its pioneering spirit in this field. There has long been a need for this type of distribution to fill special needs. Now that the method has been developed to a high degree of reliability, others should follow and give further stimulus to this new technique. Service continuity and low maintenance cost are assured. The only problem left for others to help solve is the capital cost factor.

The Electrical Week

Electric utilities are finding in their house organs a useful tool for getting across to employees information on industry problems and the free enterprise system. An ELECTRICAL WORLD study of 100 employee magazines shows increased space is being devoted to such material . . . Utility coal reserves still are near the July 1 record level of more than 28 million tons. But a few months of John L. Lewis' three-day work week would bring stockpiles down to a critical point . . . Tennessee Valley Authority sees a rosy future, with capacity being added to serve a rising load . . . The industry's output dropped slightly last week but still was ahead of the corresponding week in 1948.

To paraphrase the once-famous Dr Coue, "Every day and in every way, the capacity situation is becoming better and better." And as Dr Coue used to say, "Just recite this three times daily."

Telling time on the Pacific Coast is rather complicated these days. Washington is on Daylight Saving Time, California on Standard, Oregon on both, and Nevada on both plus Mountain Standard. But utility men don't care this year. There is plenty of power available. Besides, they assert, the effect of DST on power consumption is negligible.

Sponsors of the proposed Columbia Valley Authority are backing down on their opposition to continued work in the region by existing agencies. After terming Army Engineers-Reclamation Bureau programs a "subterfuge" to stop CVA, they suddenly started supporting the Engineers-Reclamation programs as "stop-gap" substitutes until CVA is authorized.

Italy finally has decided it must have large-scale thermal generating capacity. Continued droughts, which slowed hydro power production and crippled Italian industry, are behind this change of view. American power experts have been attempting to persuade the Italians to put more emphasis on thermal generation and less on hydro ever since the start of the European aid program.

Installation of steam boilers in Great Britain requires 18 months, compared with six months in the United States.

Many utilities are now recognizing the need for better trained and better informed supervisors, particularly at the second level of supervision. Classes or conferences are being held by some companies. Others are keeping supervisors informed through specially prepared publications.

At the end of 1948 Consolidated Edison Co of New York had the biggest fuel stockpile in its history, 2,128,000 tons of coal and 20,203,000 gal of oil. The stockpile was valued at $23 million.

Grand Coulee is increasing its lead as the greatest producer of electricity in the world. It now has 11 generators operating with a total capacity of 1,208,000 kw. Capability is about 1,400,000 kw.

Plant tours in comfort were offered delegates to the American Wood Preservers Association convention. Monsanto Chemical Co used television to show them about its St Louis plant.

Financial statements all have one fault. They tell what happened but don't tell why. Often this is the most important.

Washington Water Power Co has an expansive program to aid farm youth. It includes college scholarships for needy farm youth, short course scholarships for those desiring to study agricultural subjects, and expense funds for 4-H Club leaders desiring to take leadership courses.

Notes From The News

A court test of the withholding tax system's constitutionality may follow Treasury seizure of $6,118 from the bank account of the Kellems Co., Stonington, Conn. The funds, seized under a lien, represent a 100% penalty on taxes Miss Vivien Kellems, cable-grip maker, refused to withhold from payrolls for the second three quarters of 1948 . . . Things are going to be brighter in Butler, Pa. Its board of commissioners has reversed a 15-year-old decision that street lighting was too expensive and has directed West Penn Power Co to install 285 street lights . . . Continued excise taxes on electrical appliances and other electrical devices constitute a grave danger to the country's business prospects, says Charles G. Pyle, managing director, National Electrical Wholesalers Association. He called for repeal of the taxes imposed during the war to conserve essential materials.

Continued on following page

UNUSUAL WORKING CONDITIONS are just a part of the job for utility linemen but not this unusual. Don Morris, a lineman for a REA co-op, mops his brow as the cool and nude spectators wait for him to get back to work. They are members of the American Sunbathing Association, a nudist group, which was holding a national convention near Denver where the new line is being constructed

South Carolina Electric & Gas Co's offer to give distribution co-ops Santee-Cooper power over its lines at whatever price the Authority wants to charge still stands, Pres. S. C. McMeekin says. He had no other comment on the future course to be followed by the three South Carolina utilities who lost their case to block building of duplicating transmission lines by Santee-Cooper. Ten public utility districts in southwestern Washington counties report they have reduced their power rates to about one third those prevailing before public operation and are selling three times as much electricity per family. The consolidated report was issued by Gus Norwood, executive secretary of the Southwest Washington Public Utility Commissioners' Association. . . . Average power use per customer of Nashville Electric service went up 12.6% in the 1948-49 fiscal year, from 3,819 kwhr to 4,299 kwhr.

Construction:

Vermont farmers are continuing their five-year struggle against New England Power Co's proposed construction of a $16-million power dam across the Connecticut River at Wilder, Vt. Condemnation proceedings have been filed against 10 landowners who have refused to sell their property. Similar action has begun against New Hampshire landowners. Settlements have been obtained for 800 tracts on the Vermont and New Hampshire sides of the river . . . The next two weeks should determine whether Hungry Horse Dam, in Montana, will be the world's third, fourth, or fifth highest. It all depends on how much deeper excavating crews go in the now dried riverbed of the Flathead River's south fork. There are indications Hungry Horse may exceed the 545-ft height of Ross Dam in western Washington. Hoover Dam is 726 ft high; Shasta, 602; and Grand Coulee, 550 . . . Consumers Public Power District, Columbus, Neb., is considering spending $3 million on expansion in western Nebraska. Under consideration are a 7,500-kw addition to the Scottsbluff generating plant and construction of a series of 115-kv transmission lines to connect with Bureau of Reclamation lines in the western part of the state.

Linoma Power Co, Lincoln, Neb., has received a preliminary FPC permit for investigation of a proposed hydroelectric project on the Platte River near South Bend, Neb. Although protests had been filed by the City of Lincoln, Sanitary District No. 1 of Lancaster County, and the Chicago, Burlington & Quincy Railroad, the Commission said it was "not persuaded that it would be contrary to the public interest to discuss the merits of actual construction" of a particular development merely because existing structures might be affected. . . . Omaha Public Power District has completed a 36,000-kw, $5.5-million turbogenerator and has begun work on a 45,000-kw addition to be ready early in 1951. The district expects to spend $10 million on the additions. . . . British Columbia Power Commission is planning erection of a new $300,000 office building at Victoria, B. C.

Financial:

Hartford Electric Light Co has called a special stockholders' meeting Aug 31 to authorize an issue of $8 million in preferred stock . . . Central Ohio Light Co's offering of 25,240 additional common shares to its stockholders has been substantially oversubscribed . . . A six-page, illustrated leaflet describing Ohio Edison Co is being sent by the utility to 130,000 common stockholders of Commonwealth & Southern Corp, to whom its common stock will be distributed Oct 1 as part of the Commonwealth dissolution plan . . . As a further consequence of Commonwealth's dissolution, the Southern Co will apply for New York Stock Exchange listing of its outstanding 12,020,000 shares common stock now held by Commonwealth. Substantially all the shares will be distributed to holders of the latter's common . . . To make more information available to new stockholders, Consolidated Edison Co of New York is publishing a booklet of background material about the company. It is being sent to new stockholders, beginning July 25 along with a letter of welcome from the chairman of the board and a copy of the latest annual report.

House Organs Boost American Way

Study of 100 Utility Employee Magazines Shows More Are Trying to Inform Workers on Public Power, Free Enterprise, and Basic Economic Problems

ELECTRIC UTILITIES are making increasing use of house organs in an effort to inform their employees about America's economic system.

An ELECTRICAL WORLD survey of 100 June and July issues of utility employee magazines shows 66, almost two thirds, making some effort to get across management's point of view on such subjects as public power, taxation, cost of government, profits, or free enterprise in general. Extent of the information ranged from the indirect device of announcing a summer program change for the Electric Theater to anti-public-power articles occupying more than a fourth of the entire editorial space.

Utilities Not Unique

Utilities are not alone in this effort. The Metropolitan Life Insurance Co's policyholders service bureau, after a survey of almost 400 house organs in various fields, reported an increased number were telling employees "economic facts that affect their daily lives, their jobs, and their industries."

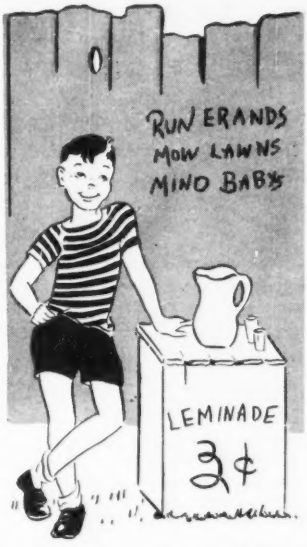
Workers are quick to resent obvious propaganda. But surveys indicate that employees want company magazines to provide more factual information about their companies and industries.

Want More Information

More than half of those questioned in a Southwestern Gas & Electric Co survey, reported in the July issue of its house organ, feel they are not well enough informed about their company's relations with governmental agencies. More than 40% would like more information about public ownership, about Southwestern G&E's community service, and about its stand on the proposed Southwestern Power Administration. A third want to know more about its profits. And 59% said they would like to get such information from the company magazine.

The house organ's present coverage of company plans and policies seems inadequate to more than half. As many more are dissatisfied with its accounts of government ownership and what the company is doing to meet this threat. Almost three fifths think the house organ doesn't say enough about how company income is divided.

General Electric Co also looked into employee reactions in its current campaign to sell GE jobs and the American economic system by the same marketing approaches used for products. Its researchers found that "Employees most definitely want management to 'say it isn't so' about the specious economics and false claims of radical union leaders, politicians, and misinformed reformers. They are seeking truth and leadership."



CARTOON based on an Electric Companies Advertising Program ad was used by Louisiana Power & Light Co house organ in a center spread discussing the merits of capitalism

What part can the house organ play in such an educational program? GE turned over three full pages in each issue of its work paper to lively, illustrated discussions of such topics as "What Did GE Earn and Who Benefited?," "How Big Are GE Profits?," and "How Would You Revise Our Job Laws?" Readership was high and results "excellent."

Washington Water Power used its employee magazine to plug, through editorials and news stories, its campaign aimed at enlisting employees actively in the fight against public power. News stories publicized workers who gave speeches, showed films, built community skating ponds, and in other ways helped build good will for the company and the privately owned utility system. A news story in the July issue quoted Pres Kinsey M. Robinson's speech at the Edison Electric Institute convention, in which he praised employees for their "great contributions" in helping the public understand the problems of the private utility business.

Few Show Plan

Few of the house organs studied in the ELECTRICAL WORLD survey gave evidence of organized plans for employee education such as those formulated by GE and Washington Water Power. Editorials, in 35 magazines, were the most popular device. Many came from syndicates or from other publications, and few offered any tie-in with specific problems of the house organs' own companies. Quotations, also usually without any local angle, were common on editorial pages and as fillers throughout the magazine. They ranged from Winston Churchill —"how it is, if this American system is so wrong, that (they) are able to keep themselves at a far higher standard of life than we are and . . . bear so large a part of our burden"—to the American Socialist party—"CVA will be a step in the direction of the authoritarian state."

Reprints Common

Reprints of articles in national magazines and syndicated material were common. Two house organs used them as inserts, one announced a magazine reprint was being sent to all employees, and one offered a copy to readers requesting it. Reprints came from such sources as *Fortune* ("TVA Was Only the Beginning"), *Public Utilities Fortnightly* ("Pattern for Public Power in New England"), and the Advertising Council, Inc ("Miracle of America"). "Basic Economics," a series of six articles prepared by the American Economic Foundation is appearing in several house organs. The Fourth of July gave an excuse for quotations from the Bill of Rights and by famous Americans as well as articles on Americanism.

Most of the Fourth of July layouts

were illustrated. But the house organs in general were far from lavish pictorially in their expositions of free enterprise. Some of the syndicated features included cartoons or maps. But unadorned type was the rule.

Advertisements supplied by the Electric Companies Advertising Program appeared frequently. Several magazines carried articles on the background and work of ECAP.

Other features had more local interest. Question box columns, usually conducted by a high-ranking executive, gave a chance to explain company policies on various subjects. Explanations of company benefits such as retirement programs contributed to a similar aim. Several house organs reported on the annual stockholders' meeting, and one included an annual report to employees.

It's hard to tell which devices go over best. Here are a few tips on technique, distilled from experience of house organ editors, public relations men, and union officials:

Avoid flowery language. Don't assume the employee knows what "free enterprise" means. Give one idea at a time; make it sincere and simple. Use cartoons. Don't lecture or talk down. Make the approach absolutely factual; avoid preaching, paternalism, and propaganda. Write for the workers, not management; appeal to them in terms of their own experience. Relate some problem of the employee's personal life to a similar company problem. Stress the employee's stake, "what's in it for him."

Judged by these standards, utilities are trying, but they still have a long way to go in what National Association of Manufacturers President Wallace F. Bennett calls their task of making employees "understand that free enterprise is the privilege of every American and that they are a vital part of it."

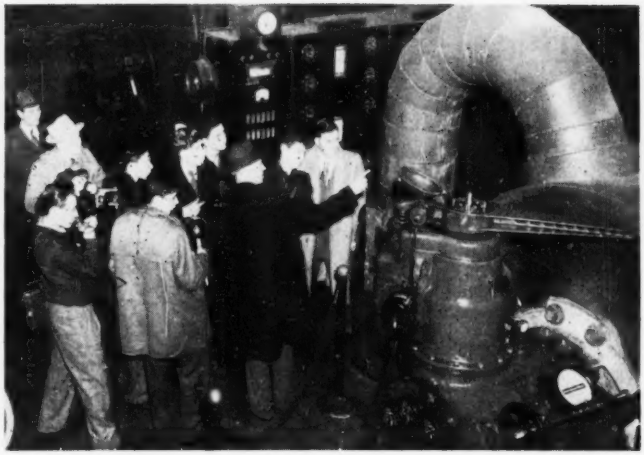


PHOTO SPECIALITIES CO sends its best photographers on a tour of Consolidated Edison's Waterside Station. The company is a Junior Achievement unit sponsored by the utility

British Columbia's Hydro Capacity over Million Hp

British Columbia hydroelectric development has passed the million-hp mark, about one twelfth of the province's hydro potential. When current expansion is competed, capacity will be close to 1.4 million hp, according to the provincial water rights branch's annual report.

Completion of the British Columbia Electric Railway's Bridge River unit and B. C. Power Commission's Campbell River Project sent combined hydro capacity to 1,005,382 hp by the end of 1948. Of this total 538,817 hp is distributed to the general public through central electric stations, 330,329 is used in the mineral and metallurgical industries, 132,280 hp goes into making pulp and paper, and the remainder is used by miscellaneous industries.

Already in the works or under construction is a further 312,750 hp. B. C. Electric is adding 124,000 hp at Bridge River, where one unit was put into operation a few weeks ago. B. C. Power Commission has scheduled an additional 112,000 hp at Campbell River and 33,000 hp at Whatshan Lake. Consolidated Mining & Smelting is adding 37,000 hp at Brilliant and the City of Nelson another 6,750 at Bonnington.

•

Rates Are Set to BCER

The rate for power to be supplied to British Columbia Electric Railway Co by British Columbia Power Commission has been set at $2.2333 a kw monthly. Under terms of the agreement, which goes into effect Oct. 1, 1950, the utility will take a minimum of 17,500 kw a month to supplement its supplies in the lower Vancouver Island area. The Commission has agreed to provide up to a maximum of 42,500 kw per month. The contract is for 25 years, with an option for a 15-year renewal.

•

IBEW Recognition Voted

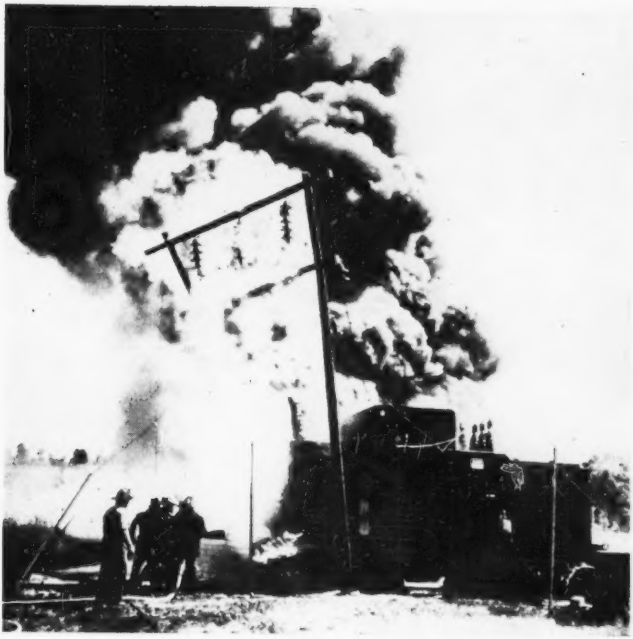
Flora, Ill., voters in a referendum election have ordered the city council to recognize the International Brotherhood of Electrical Workers, AFL, as bargaining agent for the 19 city employees who struck March 16. The men were employed at the municipal light and water plants and on city-operated buses.

IBEW Backs Paper That Backed It

The publisher of a semi-weekly newspaper who defended the IBEW's month-long strike at the municipal power plant in Flora, Ill., has been given an $11,500 loan by IBEW's international office to pay off a mortgage on the paper.

The newspaper is the Flora (Ill.) *Sentinal.* The publisher, Charles A. Crowder, said he accepted the loan "in the interest of freedom of the press." He charged that a group of business men were trying to foreclose on the mortgage because of the newspaper's support of the strikers.

Operating and maintenance employees struck the power plant over the city's refusal to recognize IBEW Local 702 as bargaining agent, according to IBEW headquarters in Washington. City officials take the position that they cannot contract with a union to represent city employees. The National Labor Relations Board does not handle cases involving government workers.



FIRE SWEEPS 20,000-kva mobile transformer of Louisville Gas & Electric Co. The mobile unit was on location at a substation where less than a week previously two transformers had gone out of operation. Another transformer has been borrowed from Kentucky Utilities Co to replace the damaged units. The substation serves radio station WHAS

Utility Coal Stocks at Near-Record High; 3-Day Work Week a Threat

ELECTRIC UTILITY leaders kept watchful eyes on the negotiations resumed this week by coal mine operators and the United Mine Workers. But no one seriously expected an early settlement of the now perennial dispute.

Power company coal stocks generally still were at levels near the record supply on hand July 1. At that time electric utility power plants had coal reserves totaling 28,351,485 tons. It probably will take several months of UMW's three-day work week for miners, plus usual cold-weather fuel demands from other coal consumers, to bring this stockpile down to the critical point.

But this eventually is exactly what is feared by utility and other industry observers. They believe UMW Pres John L. Lewis may stall negotiations with the mine operators until big industry coal users are short to put more pressure behind the mine workers' contract demands.

Meanwhile, UMW officials met Aug 10 with operators of Southern mines at Bluefield, W. Va. Negotiations with Northern and Western bituminous operators and captive-mine owners were resumed the next day at White Sulphur Springs, W. Va. UMW contract negotiations with anthracite mine operators traditionally follow and are patterned after settlements with the bituminous group.

The UMW bituminous mine contracts expired last June 30. Instead of calling a strike, however, Lewis directed his miners to go into the pits only three days a week, rather than the usual five days. There has been considerable talk of legal action against this order on grounds that it might constitute a restraint of trade. But neither the mine operators or the government has filed suit yet.

The electric utilities' record July 1 coal stocks consisted of 25,606,686 tons of soft coal and 2,744,799 tons of anthracite. The total represented 47% more than the industry's reserves on July 1, 1948. At the June rate of consumption—6,338,395 tons of bituminous and 257,180 tons of anthracite burned—the stocks would be sufficient to last the industry 129 days.

In addition to the coal reserves, the industry had 8,072,314 bbl of fuel oil in reserve on July 1, a 49-day supply at June levels of oil consumption. Electric utilities also were using record amounts of natural gas—52,248,594,000 cu ft during June.

But a prolonged strike, or even continued low mine output, by the coal miners eventually would hit the industry hard. Small companies and some municipal systems have far less than the average of 129 days' supply of coal on hand. If the current UMW-operators negotiations bog down, making it apparent that no agreement can be hoped for before fall, these systems will be in difficulty quickly.

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Tacoma Asks Dams' OK Despite Legislative Ban

The City of Tacoma has applied to the Federal Power Commission for permission to build two dams on the Cowlitz River, despite action by the Washington Legislature creating a fish sanctuary on the river.

The city claims the state has no jurisdiction. Its plan will provide adequate protection to fish life, J. Frank Ward, City Light superintendent, said. The plant at one dam near Mossyrock would have a capacity of 225,000 kw. The other, near Mayfield, would contain three 40,000-kw generators.

•

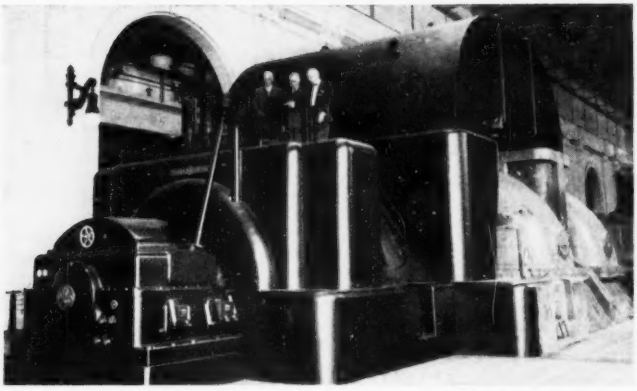
Seaboard Will Add Unit

Seaboard Power Corp, Glace Bay, Nova Scotia, will build a new steam generating unit that will increase capacity at the Glace Bay plant from 17,000 to 37,000 hp. An issue of $2.6 million in first mortgage serial 4% bonds has been sold in full. The plant was made necessary by the electrification program now in progress in the Cape Breton Island soft coal mines.

•

Genoa to Improve Plant

Genoa, Ohio, Village Council has approved issuance of mortgage revenue bonds for a $30,000 extension and improvement of its municipal power plant. Toledo Edison Co, from which the city buys power, has offered to buy the municipal system, but the Council considers its utility too profitable to sell.



ATOP the new 150,000-kw turbo-generator at Commonwealth Edison's Fisk Station in Chicago, three officials make an inspection. Left to right are Charles Y. Freeman, chairman of the board; President Edward J. Doyle; and Alex D. Bailey, vice-president in charge of operations. Total station capacity is now 473,000 kw, largest of ten system stations

Commission Takes Over 3 Private B. C. Utilities

British Columbia Power Commission is taking over three private electric utilities in the Windermere region in the interior of the province and will spend $224,350 establishing a public power system there.

The Commission has purchased an electric distribution system at Invermere for $4,000, a diesel generating unit and distribution system at Athalmer for $9,000, and a distribution system at Edgewater for $2,086.

These will be centralized into the Commission's scheme, which calls for putting in a diesel generating unit at a cost of $224,350 to serve the entire Windermere area, where there are 250 customers. Later the diesel plant may be replaced by a hydro scheme on the Spillimacheen River.

•

To Triple Plant Capacity

Southwestern Public Service Co plans to more than triple capacity of its Moore County plant in Texas, by installation of an 18,750-kw steam turbine generator. The new unit is scheduled for use late next year.

•

Danville Rejects Contract

Danville, Va., City Council has decided not to renew a contract with Appalachian Electric Power Co for standby power. Instead the city will renovate an old steam plant, to be used in addition to the Patrick County hydro plant and a new $1.5 million steam power plant now being readied for service. Opponents of the council action warned that load requirements might not be met if a drought cut the hydro station's efficiency.

•

PG&E, Sacramento MUD Finally Agree on Price

Pacific Gas & Electric Co and the Sacramento Municipal Utility District have agreed that $2,285,000 is a fair adjustment due PG&E on the original purchase price of the system.

An initial payment of $11,632,000 was made when the municipal took over Dec 31, 1946. This figure was approved by the Public Utilities Commission in 1938. The additional amount the company will receive is for costs of additions and improvements since 1938 less retirements, loss, and depreciation.

First adjustment figure set by PG&E engineers was for $4 million while the Sacramento MUD engineers arrived at $1.7 million. The new amount will be submitted to the PUC for approval.

•

Co-op Given Franchise

A franchise for a power distribution system to cost about $1 million was granted to the Death Valley Electrical Cooperative, Inc. by the San Bernardino County Board of Supervisors on July 25. The cooperative plans to build some 300 miles of lines in southeastern Inyo County, the northeast corner of San Bernardino County, and portions of western Nevada. Funds are expected from the REA.

Senate Launches Debate on Transmission Lines

The Senate finally launched upon its most important power policy debate in a decade this week.

Core of the battle is a proposal by the Senate Appropriations Committee that the Interior Department make wheeling agreements with several power companies instead of building federal transmission lines. The Committee slashed funds for the proposed lines from Interior's annual appropriations for fiscal 1950. The House previously had approved the bill with the transmission line money intact.

The Senate committe ordered Interior to attempt to negotiate wheeling agreements in its report on the Department's appropriations. That report went to the Senate on July 13. The Interior bill was shunted aside for nearly a month, however, while the Senate took up other matters. The last of these measures, appropriations for Economic Cooperation Administration, was approved Monday, clearing the way for the Interior bill.

The long delay apparently was most beneficial to Interior and others seeking restoration of the transmission line money. Unofficial checks of the Senate indicated that this group would be able to muster sufficient votes to override the Committee proposal. Vote on the bill was expected late this week.

Congressional experts termed the wheeling-agreement proposal the most important power issue before Congress since it adopted the 1944 Flood Control Act. That legislation, in its now famous Section 5, gave Interior responsibility for marketing power from hydroelectric projects built by the Army Engineers. It also directed that preference in the sales of such energy be given to government agencies, other public bodies, and cooperatives.

•

City to Buy Utility

Ottawa City Council has voted to buy the Ottawa Light, Heat & Power Co for $7.6 million. Approval by the company's stockholders and by the Ottawa Hydro-Electric Commission is still needed.

•

Hammer Quitting PUC

John W. Hammer, chairman of the Tennessee Railroad and Public Utilities Commission, will retire at the end of his present term. He has said he will not be a candidate for renomination in the August, 1950, Democratic primary.

NEW SALES TOOL for use by commercial lighting salesmen is demonstrated to J. T. Coatsworth, commercial director of EEI, by G. R. Trumbull, manager, Better Light Better Sight Bureau. The compact slide viewer, small enough to fit in the palm of the salesman's hand, weighs only 20 ounces. It is accompanied by 43 full-color slides illustrating outstanding commercial Planned Lighting installations. The set may be ordered from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y., at $5 for the viewer and $10 for the slides. Prices to non-members of EEI are 10% higher

TVA Looking Ahead to Rosy Future, Adding Units to Serve Rising Load

TENNESSEE VALLEY Authority is looking ahead to a rosy future. This was indicated in statements by TVA officials to ELECTRICAL WORLD. Here are the reasons why:

1. By 1952, TVA will add 804,500 kw of capacity and will pick up another 171,000 kw from other projects in the territory, making a total of 1,275,500 kw.

2. Work at New Johnsonville steam plant is progressing nicely. The first 125,000-kw steam unit is to go into service in January, 1952. The other two are to follow at two-month intervals.

3. Power load is increasing. It is up 9% over last year. But water conditions have been excellent so far this year, the best in 15 years. All the reservoirs are practically full. At Fontana and Douglas Dams it has been necessary to spill water.

4. Although operating costs have increased over the past few years, TVA is not considering at this time any increase in its power rates.

TVA's schedule for additional capacity includes these installations:

1949—Wilson Dam, 25,200 kw; Watauga Dam, two 25,000-kw units.

1950—Wilson Dam, three 25,200-kw units; Wheeler, two 32,400-kw units; Wilbur, 7,000 kw; South Holston, 35,000 kw.

1951—Chickamauga, 27,000 kw.

1952—Hales Bar, two 24,300-kw units; Guntersville, 24,300 kw; Pickwick, two 36,000-kw units; New Johnsonville, three 125,000-kw units.

Aluminum Co of America at Cheoah Dam is raising the top of the gates and installing the fifth 30,000-kw unit. TVA is operating this project. TVA is also operating the Corps of Engineers Cumberland project of two 18,000-kw units and will operate the Center Hill project when the three 45,000-kw units are put into service. The same will be true of the six 45,000-kw units to go in the Wolf Creek project when it is completed in 1951-52.

By 1952 all firm power contracts with connecting private utilities will have expired and only day-to-day interchange contracts will be in effect. This will give TVA 140,000 kw additional within its system.

Late in July TVA placed in service a new 154-kv line between Great Falls and Nashville to replace a 110-kv line. This strengthens the interconnection between the East and West systems.

They Found a Way

Employees of the Faith, S. D., municipal system found the way to get their long overdue pay checks. They pulled the main switch at the municipal power plant. Left in the dark, the citizens "put pressure" on City Council. The men got their pay.

•

2 Men Killed in Explosion at Feather River Project

Two men were killed July 30 at Rock Creek tunnel in Pacific Gas & Electric Co's Feather River hydroelectric project (EW, July 23, p 16-17) when dynamite charges were exploded prematurely by lightning.

Company officials reported that George W Spears and Robert Reynolds, both of Oroville, Calif., were killed when about 10 out of 60 charges in a partly loaded 25-ft section heading were apparently detonated by lightning conducted by a wet seam in the rock. Seven other men of the 20 in the tunnel employed by Arundell Corp and L. E. Dixon, contractors, were treated for minor injuries, officials said.

The freakish summer electrical storm, a type rarely seen on the West Coast, caused many momentary service interruptions when lightning hit transmission wires in its path. One bolt scored a direct hit on a bank of transmitters at the company's Station G at El Cerrito, but service was restored within a few minutes.

•

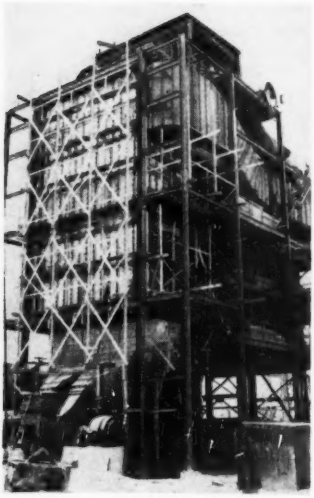
Anti-Strike Law Amended

Amendments to New Jersey's public utility anti-strike act were passed by the Legislature at the end of a special session. The bill, setting up standards on which arbitration boards can base their decision in wage disputes, resulted from a recent state supreme court decision holding a section of the law unconstitutional.

•

Storm Teams Formed

With the hurricane season approaching, Florida Power & Light Co is organizing storm restoration teams to handle power line breaks in case of emergency. The Southern Division is divided into 25 areas for restoration work and has a team of approximately 400 in the different crews.



MISSISSIPPI Power & Light is becoming a power producer rather than purchaser with installation of a second 44,000-kw, $4.5-million unit at Rex Brown station. Above is 450,000-lb-per-hr outdoor-type boiler

Libraries Can Buy EW in Microfilm Volumes

ELECTRICAL WORLD is to be made available to libraries in microfilm. Under an agreement between McGraw-Hill Publishing Co and University Microfilms, Ann Arbor, Mich., sales are to be restricted to those subscribing to EW. Film will be distributed only at the end of the volume year.

The positive microfilm will be furnished on metal reels. Inquiries concerning purchase should be directed to University Microfilms, 313 N. First Street, Ann Arbor, Mich.

The same arrangement has been made for a number of other McGraw-Hill technical journals.

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Plan Hoh River Survey

The Rural Electrification Administration has authorized the Clallam County PUD of Port Angeles, Wash., to retain Henry L. Gray of Seattle to make an engineering survey of proposed hydroelectric development on the Hoh River.

•

Fuel Clause Rejected

Hubbard, O., City Council has rejected a proposed Ohio Edison Co contract linking the village power rate to the price of coal.

Contract OK'ed for City That Voted Down USBR

California Public Utilities Commission endorsement has been given to a contract between Pacific Gas & Electric Co and the City of Redding, a renewal approved in a recent city election in which voters chose PG&E power over wholesale electricity offered by the Bureau of Reclamation (EW, July 9, p 14).

The new contract offers power at 10% below the utility's standard rates to municipalities and 5% below its former contract, a reduction, PG&E said, granted "to avoid the loss of the city as one of the company's electric resale customers." The contract became effective with the Commission's action and will continue until Aug 26, 1955.

In permitting the utility to reduce its rates to meet competition, the PUC pointed out that "if it should appear in a rate proceeding that any losses are being incurred because of such adjustments, they will be treated as losses which are not to be imposed on other customers."

•

New Contract Is Signed

Columbiana, Ohio, Board of Public Affairs signed a new 10-year power contract, Aug 1, with Ohio Edison Co. Rates were increased slightly. The village owns its own distribution system.

MEETINGS

American Institute of Electrical Engineers
Pacific General Meeting, Fairmont Hotel, San Francisco, Calif., August 23-26; Midwest General Meeting, Netherland Plaza Hotel, Cincinnati, Ohio, October 17-21.

Maryland Utilities Association
Fall Conference, Cavalier Hotel, Virginia Beach, Va., September 9-10.

Rocky Mountain Electrical League
Fall Convention, Stanley Hotel, Estes Park, Colo., September 11-14.

Instrument Society of America
Clinic on Maintenance of Industrial Instruments, Statler Hotel, St. Louis, Mo., September 9-12; Annual Convention, Municipal Auditorium, St. Louis, September 12-16.

Missouri Valley Electric Association
Rural Round-Table, President Hotel, Kansas City, Mo., September 14; Sales and Rural Conference, President Hotel, Kansas City, Mo., September 15-16; Accounting Conference, Robidoux Hotel, St. Joseph, Mo., October 20-21.

Public Utilities Association of the Virginias
Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., September 16-17.

American Chemical Society
National Meeting, Hotel Traymore, Atlantic City, N. J., September 18-23.

Southeastern Electric Exchange
Engineering and Operating Section, Hotel Roanoke, Va., September 19-20; Accounting Section, Henry Grady Hotel, Atlanta, Ga., September 22-23; Personnel Administration Section, Henry Grady Hotel, Atlanta, Ga., September 23; Sales Conference, Biltmore Hotel, Atlanta, October 26-28.

Illuminating Engineering Society
National Technical Conference, French Lick Springs Hotel, French Lick, Ind., September 19-23.

Pennsylvania Electric Association
Annual Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., September 20-21; Transmission and Distribution Committee, Fort Ligonier Hotel, Ligonier, Pa., October 20-21.

Edison Electric Institute
Accident Prevention Committee, Robert Treat Hotel, Newark, N. J., September 22-23; Electrical Equipment Committee, Hotel Van Curler, Schenectady, N. Y., October 3-5; Meter and Service Committee, Leland Hotel, Springeld, Ill., October 3-5; Transmission and Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., October 31-November 1.

Wisconsin Utilities Association
Annual Convention, Accounting Section, Dell View Hotel, Lake Delton, Wis., September 22-23; Joint Annual Convention, Electric and Gas Sections, Schroeder Hotel, Milwaukee, November 21-23.

National Electronics Conference
Edgewater Beach Hotel, Chicago, Ill., September 26-28.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., September 28-30.

National Television and Electrical Living Show
Second Annual Show, Sponsored by Chicago Electric Association, Chicago Coliseum, September 30-October 9.

National Association of Corrosion Engineers
South Central Region, Adolphus Hotel, Dallas, Tex., October 3-4.

Association of Iron and Steel Engineers
Annual Convention (without exposition), William Penn Hotel, Pittsburgh, Pa., October 3-6.

Canadian Electrical Manufacturers Association
Annual Meeting, General Brock Hotel, Niagara Falls, Ont., Canada, October 4-6.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Iowa, October 10-11.

American Society for Testing Materials
First Pacific Area National Meeting, Fairmont Hotel, San Francisco, Calif., October 10-14.

American Standards Association
Annual Meeting, Waldorf-Astoria Hotel, New York, October 11-14.

International Association of Electrical Leagues
Annual Conference, Hotel Cleveland, Cleveland, Ohio, October 12-15.

Electrochemical Society
Fall Congress, La Salle Hotel, Chicago, Ill., October 12-15.

National Safety Council
National Safety Congress and Exposition, Stevens, Congress, Morrison, Sherman Hotels and the Palmer House, Chicago, Ill., October 24-28.

National Metal Trades Association
Annual Convention, Palmer House, Chicago, October 26-28.

National Electrical Contractors Association
Annual Convention, Rice Hotel, Houston, Tex., November 8-11.

National Electrical Manufacturers Association
Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., November 14-18.

Refrigeration Equipment Manufacturers Association
All-Industry Refrigeration and Air Conditioning Exposition, Atlantic City Auditorium, Atlantic City, N. J., November 14-18.

No Additions this week.

Output Declines Slightly; Total Is 2.8% Over 1948

Closely following the 1948 curve output dropped off during the week ended Aug 6 to 5,466,004,000 kwhr from the 5,518,485,000 kwhr reported for the previous week. The increase over the corresponding week of 1948 for the United States was 2.8%.

The slight increase over last year has had two beneficial effects. 1. It has enabled the utilities to build up a capacity reserve. 2. It has enabled many of them to increase their stocks of coal. The latter is important in view of the three-day week now the official schedule of the soft-coal miners.

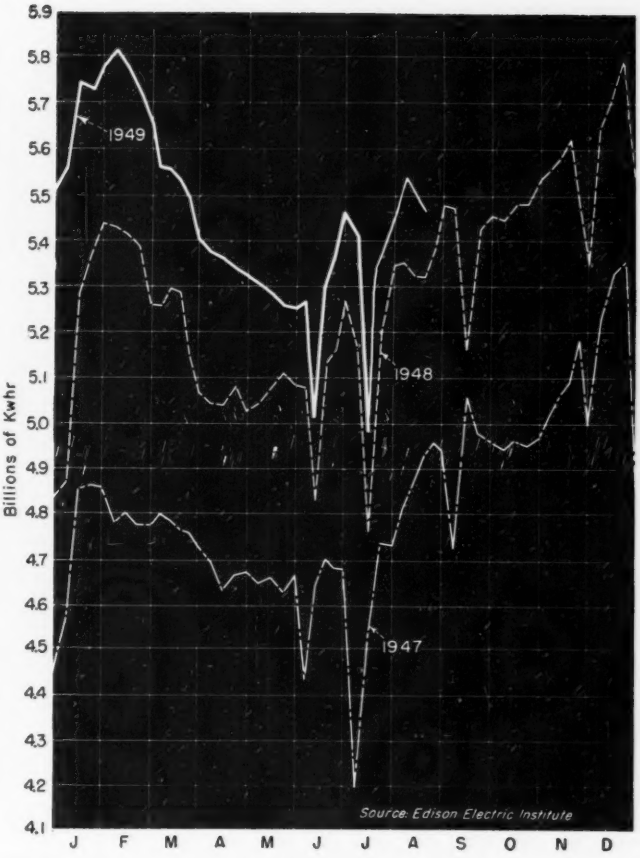
Two areas showed decreases from last year. The Middle Atlantic States stayed in the minus column with 1.6%. The Central Industrial area returned to the minus column with 1.7%.

Weekly Output, Millions Kwhr

1949	1948	1947
Aug. 6 5,466	Aug. 7 5,319	Aug. 9 4,874
July 30 5,518	July 31 5,352	Aug. 2 4,806
July 23 5,462	July 24 5,342	July 26 4,730
July 16 5,342	July 17 5,197	July 19 4,732
July 9 4,982	July 10 4,760	July 12 4,531
July 2 5,410	July 3 5,166	July 5 4,190
June 25 5,466	June 26 5,257	June 28 4,675
June 18 5,373	June 19 5,159	June 21 4,676
June 11 5,300	June 12 5,132	June 14 4,702
June 4 5,018	June 5 4,845	June 7 4,635
May 28 5,270	May 29 5,076	May 31 4,429
May 21 5,255	May 22 5,085	May 24 4,663

Percent Change from Previous Year

	Aug. 6	July 30	July 23
New England	+ 4.0	+ 3.1	+ 2.5
Mid-Atlantic	— 1.6	— 0.0	— 0.8
Central Industrial	— 1.7	+ 0.3	— 2.2
West Central	+ 3.2	+ 4.3	— 3.0
Southeast	+ 6.3	+ 4.7	+ 1.7
South Central	+ 5.3	+ 5.1	+ 8.4
Rocky Mountain	+11.9	+10.1	+15.7
Pacific Coast	+ 7.6	+ 6.7	+ 7.4
Total United States	+ 2.8	+ 3.1	+ 2.2



Energy Sales in April Advanced 5.3% over '48

Sales of electric energy to ultimate customers in April totaled 20,419,691,000 kwhr, Edison Electric Institute reports. This was a 5.3% increase over the 19,400,000,000 kwhr sold in April, 1948.

Classification of Sales, April

Kilowatthour Sales April	Million Kwhr 1949	1948	Percent Change
Residential or domestic	4,763	4,159	+14.5
Rural (Distinct rural rates)	531	463	+14.7
Commercial or industrial			
Small light and power	3,685	3,450	+ 6.8
Large light and power	10,141	10,014	+ 1.3
Street & highway lighting	205	188	+ 9.3
Other public authorities	522	509	+ 2.5
Railways and railroads			
Street and interurban	313	339	— 7.8
Electrified steam railroads	212	221	— 3.8
Interdepartmental	48	57	—16.0
Total to ult. cust	20,420	19,400	+ 5.3

Revenues from ultimate customers amounted to $374,712,800 in April, an increase of 8% over the $346,888,800 reported for April, 1948.

For the 12 months ended April 30, the average use per residential customer rose to 1,607 kwhr, a 7.9% increase from the 1,490 kwhr of the previous year; the average annual bill to $47.89 from $45.30, an increase of 5.7%. Revenue per kilowatt hour dropped to 2.98¢ from 3.04¢, a decrease of 2%.

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Southern Co Begins Suit

The Southern Co, now incorporated in Delaware, has begun a friendly suit against the State of Georgia to find out if stock holdings in subsidiary firms outside the state are subject to Georgia's intangible tax law. The action was begun in Fulton Superior Court. The Southern Co wishes to become a Georgia corporation.

PG&E Sets Load Record with Over 2.3 Million Kw

Pacific Gas & Electric Co carried a record peak load of 2,309,000 kw on its system, July 27, 180,700 kw over last year's peak, set in August. Summer peaks in California are a result of agricultural load, with large demands made by irrigation pumping.

The new peak is nearly double the last prewar peak load set on Dec 8, 1941, of 1,217,700 kw. Daily energy consumption has also nearly doubled, with a present 44,250,000 kwhr daily over 22,837,000 kwhr in 1941.

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Martin Named to PUC

Roy O. Martin, Jr, executive secretary to the Toledo city manager, has been appointed to a six-year term on the Ohio Public Utilities Commission. He succeeds Paul E. Weiland, Lancaster.

WASHINGTON COMMENT

WILLIAM B. WHICHARD

PRACTICALLY everyone has had his say about annual appropriations for the Interior Department—government, the power industry, labor, farm groups. Everyone, that is, but John Q. Taxpayer, the little man who pays the fiddler but somehow never gets to dance.

It looked briefly as if John would get an unforeseen break when the Senate Appropriations Committee acted on the fiscal 1950 budget for Interior. Briefly the committee eliminated funds sought by two Interior agencies for certain transmission facilities. Instead it directed these bureaus to take up several local power companies on offers to transmit government energy.

The privately owned utilities had told the Senate committee they would transmit Interior power on terms similar to those voluntarily negotiated two years ago by the Department and Texas Power & Light Co. But the committee was buying no pig in a poke.

First, it instructed Interior's Reclamation Bureau and Southwestern Power Administration to attempt to negotiate with the companies contracts incorporating the "basis principles" of the Texas agreement. It was pretty clear during the Committee hearings, if not in the Committee's report, that the Senators had in mind some form of wheeling agreement beyond the specific terms of the Texas contract. Second, Reclamation and SPA were under no real duress. They were ordered to negotiate, then report back to the Committee by next Jan 1 on "progress" of the parleys. Again it was clear that if the Interior-company negotiations were bogged down at that point, the Committee intended to give Reclamation and SPA money to build the facilities in question. Thus, in effect, the two agencies faced at worst only a five-month delay in their respective transmission programs.

The immediate saving of the committee's proposal was piddling—about $10 million as against a total $590 million approved in the bill for Interior's 1950 expenditures. But the long-range possibilities might prove considerable.

Reclamation Bureau alone has a 1948-57 program for construction of transmission lines and related plant that will cost an estimated $562 million. How much of that sum the Bureau could save the government through line-use agreements with power companies would depend, of course, on how far the companies would be willing to go in such negotiations, upon the willingness of both parties to compromise, and on other factors.

SPA, which in 1947 was happy to conclude the Texas contract, was planning a $30-million transmission net—most of which would not be built if it agreed on terms with the power companies in its area. A general acceptance by industry and the government of contracts of this type also might save unestimated millions of U. S. funds for federal transmission in the Southeast and other areas soon to have large government hydro developments.

Much has been said, but little done, about economy in the federal government. Since nearly two thirds of annual U. S. spending goes for irreducible costs—payments on the national debt, defense, and other fixed obligations—it is a real problem. But federal power spending is outside this fixed-charge area.

At any rate it looked good for old John Q., but not for long. Well before the bill reached the Senate floor, it had aroused a storm of protest. Reclamation and SPA spokesmen averred the Texas contract would not "work" in other areas—probably an accurate statement but somewhat beside the point. National Rural Electric Cooperative Association termed the committee proposal a "scheme" to "destroy" federally financed electric co-ops—a record flight into fantasy, even for NRECA. And CIO, apparently without advice of its better informed Utility Workers Union, termed it a plot to "steal public power."

No one spoke for John Q. Taxpayer in tones louder than an inaudible whisper.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Flicker voltage drop is usually the dominant design consideration at low load densities and that favors banked secondary mains because motor starting currents are supplied by more than a single transformer.

Distribution transformers larger than necessary for thermal objectives can be an economical method of overcoming flicker voltage drop, particularly in areas of light load density.

Turbine governors ideally should afford flexible and instantaneous response to the valves and a practically linear relation between plant output and camshaft travel, both without sacrifice in economical results from valve overlap.

Rectifiers are not seriously damaged by arc-backs unless sustained or repeated in rapid succession; consequently automatic reclosure of the breakers is usually permissible.

Carrier application calls for specific knowledge of the high frequency impedance as it becomes more complicated by extension involving indoor circuits, long coaxial lines, remote tuning and matching, a single coupling capacitor for several channels, etc.

Sheath-bonding transformers reduce circulating currents in sheaths of power cables but they do present a high-loss return path if an attempt is made to transmit carrier over the cable.

ROLLER BEARING SWIVELS between the wire-rope pulling line and basket type cable grip—shown being installed—kept messenger uppermost during pulling. The 1,000-ft reel of 15-kv aerial cable is mounted on trailer with specially mounted reel jacks

Pulling 15-Kv SS Cable Can Be Routine

Routine distribution construction methods used in installing 15-kv aerial cable with 4/0 conductors in tree-dense area. Heavy cable pulled in 1,000-ft sections

A. C. FORT and J. V. CARVER
Jersey Central Power & Light Co
Morristown, N. J.

CONSTRUCTION of 15-kv type SS aerial cable lines can be as routine as the installation of the 5-kv size for distribution purposes.

The Jersey Central Power & Light Co recently proved this when its forces designed and built a 4.5-mile line of three-conductor, 1/0, 15-kv SS aerial cable as just such a standard distribution task. Although the method of installation was something of an innovation, the installation forces needed none of the extensive and special field engineering supervision hitherto required on such jobs.

True, some of the equipment by which the cable—weighing about 6,000 lb net—was pulled in one operation on to existing poles in 1,000 ft sections had to be improvised. True, unforeseen difficulties were encountered because of the heavier weight and larger diameter of this particular cable. Nevertheless, the experience showed that normal field forces can undertake higher-capacity aerial cable construction with standard line construction materials and equipment.

The area through which the line was built is decidedly not standard. The high-income commuting families, whose lovely northern New Jersey homes decorate the rolling terrain around Summit, Short Hills and Millburn, live under the splendor of valuable shade trees. Tree density and tree affection are extreme.

Moreover about half of the route distance—11,665 ft—is along a public highway, where existing poles

CONTINUED ON NEXT PAGE

PULLED UNDER TENSION of 1,000 to 2,000 lb the cable was kept off the ground and clear of foreign objects between poles. The home-made reel brake, shown, was improvised using a large jack. Apprentice linemen contended for post as brakeman. Author Fort is at left

ALOFT on pole lineman attends passage of cable pulling grip and 3.69 in. cable through stringing block bolted to pole

Although Many Problems Were Met With, 4.5 Miles Of

carry telephone equipment below the clamping position for the cable.

Of the 10,769 route feet on private property, the greater portion is along the Lackawanna Railroad tracks, inaccessible except to four-wheeled-drive trucks at intervals of about 1,500 ft.

These were three substantial reasons—tree conditions, impeding equipment and inaccessibility—against laying cable along the ground and hoisting to poles.

On the other hand there are few straight sections along the cable's 4.5-mile route between the company's Summit and Millburn Substations. This condition frequently required pulling around angles of deflection of from 5 to 90 deg. The poles were therefore first readied with cable blocks. Blocks on angle poles were reversed to allow swinging under the unusual weight.

Cable was transported to the starting point on a flat, low-wheeled trailer equipped with specially-mounted, standard reel jacks. Since it was to be pulled under tensions of 1,000 to 2,000 lb and kept off the ground and clear of foreign objects between poles, a homemade reel brake was improvised. This contrivance, which was controlled by a large jack, stole the show: the apprentice linemen, seven of whom were added to the task force of one regular line crew, contended for brakeman's post.

Swivels Attached

To keep the messenger topmost (for appearance's sake) one or more roller bearing swivels was attached between the wire-rope pulling line and the cable end. Cable-end pulling eye was made up in the usual way.

Linemen attended the entry of the pulling basket through each block and the cable was held under approximately 1,500 lb tension during the pulling operation. The initial stringing tension was determined by sag measurement.

After sagging, the cable was permanently clamped into position. Then experienced cable splicers joined the sections. Because this was possibly the most important part of the line's construction special precautions were taken to insure against splice failure. All splicing and shielding was completed with extreme care, the shielding was grounded every 1,000 ft and, wherever possible, shield grounds were tied to the multi-grounded distribution neutral system. To warm the splicing material, tents were used even on the clear, mild winter days. A splicer and his helper were able to rig tent and platform and make a 3-conductor splice in eight hours.

BENDING AROUND a sharp angle the type SS aerial cable passes through a reversed cable block to allow swinging

TYPICAL of the residential area through which the Jersey Central pulled its 4.5-mi 15-kv SS aerial cable, here shown being pulled into final position. Tree density resulting from cultivation of shade trees by residents is extreme in this area, decidedly not a standard one

Aerial Cable Was Strung Using Standard Methods

Because of inability to get aerial clearances or right-of-way, a total of 1,360 ft of the same cable—neither spiraled nor messenger attached—was placed underground in the vicinity of the Short Hills railroad station and of the Millburn Substation.

Approximately 100 man hours were required per 1,000 ft, including pulling, sagging, placing the messenger in clamps, and splicing. In the August 7, 1943 issue of ELECTRICAL WORLD the present authors reported an early installation in the same region of lower-capacity, self-supporting aerial cable that required 70 man hours per 1,000 ft. The cost of poles, guys, and other equipment depends, of course, on the amount of existing construction and the type of territory.

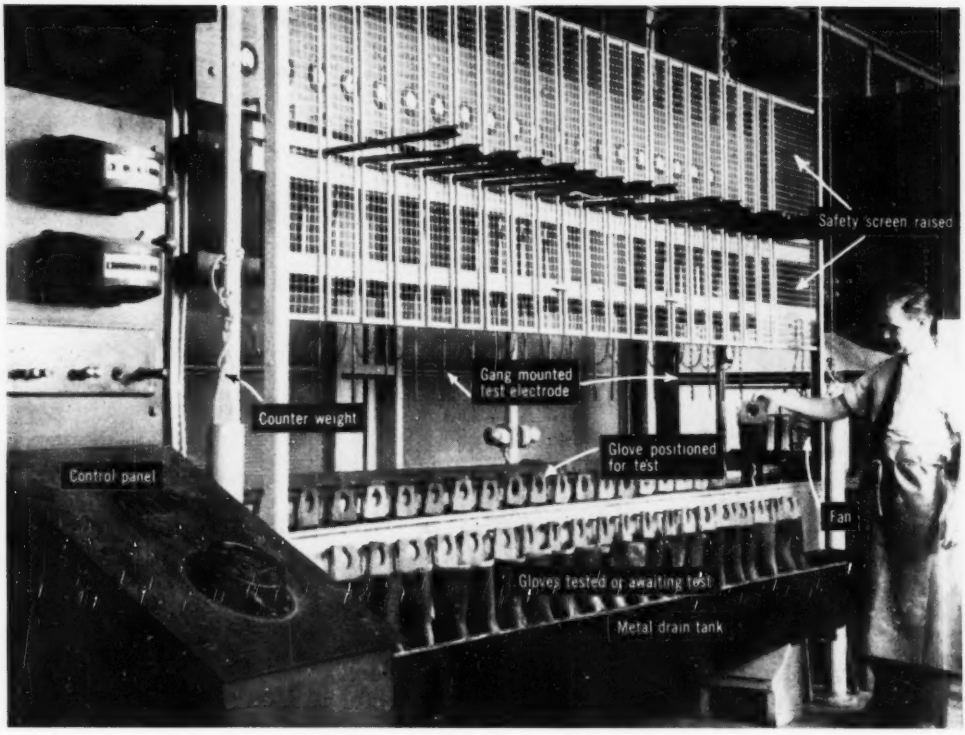
Cable specifications were for 3-conductor, 15-kv grounded neutral aerial cable; 4/0 copper conductor, semicon tape; 19/64 in. compound insulation; cabled tape; paper tape; 0.005 in tinned copper tape; cabled tape; 6/64 in neoprene jacket. The three conductors cabled and bound to a ½-in. extra-high strength 30% Copperweld messenger with a 0.375 in. by .040 in. copper tape.

Swivels Not Streamlined

Experience with the job indicates that the roller bearing swivels now available are not designed with sufficient streamlining to allow full freedom of entry into cable blocks. It was found necessary to tape padding or cushioning material to swivel ends for easy entry. The diameter of the sheaves of the blocks also proved too small for the weight and diameter (3.691 in outside) of 15-kv cable. The working diameter was increased by vulcanizing a rubber lining to the work surface of the sheave. Sheaves for this cable should have 8 in. minimum diameter. When using blocks with an 8 in. or smaller diameter it is necessary to maintain a low pulling tension when pulling around sharp angles. The length of cable in contact with the sheave surface increases with the tension, thereby reducing the radius of bend for the conductor. The contact with the sheave surface should be held to a point contact if possible.

Since cable blocks must be able to adjust to strain, their design should follow that of the standard snatch block. This would increase their flexibility where corners are pulled and allow for shifting of newly set poles.

The total cost of this type cable in place is about 40% less than conventional lead and armored cable supported in cable rings on a standard messenger. Present experience indicates that the operation of the two cable types should be similar.



1 **ELECTRODES DROP AUTOMATICALLY** into the gloves when the screen is closed. This eliminates placing 20 individual electrodes into the gloves and afterwards having to remove them manually. Interlocks prevent application of test voltage when screen is up.

Safeguarding Volume Testing Of Rubber Gloves

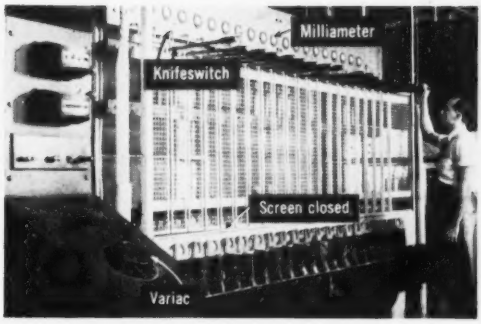
Automatic electrode positioning permits testing of 40,000 gloves yearly

LYMAN S. SALMONSEN, Asst Engineer, New England Power Service Co Central Laboratory, Worcester, Mass.

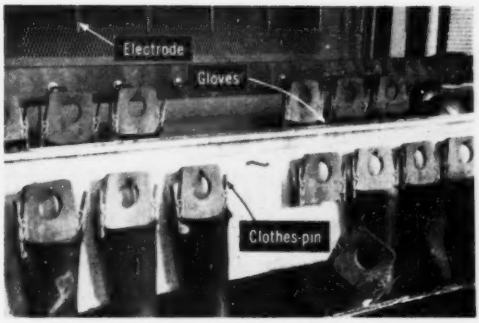
NEW TESTING equipment became essential when the New England Electric System faced the problem of checking 40,000 rubber gloves yearly. This was a task accompanying the consolidation of rubber goods testing at the central laboratory established in 1948 at Worcester, Mass. Major techniques for glove testing were set up as follows: (1) Strict adherence to ASTM specifications; (2) safety screen with interlock; (3) an individual milliammeter for each glove to avoid switching a single meter and afford continuous readings; (4) automatic electrode insertion and withdrawal from gloves; (5) provision for Class A glove testing at 20 kv; (6) ability to test 20-in. or 14-in. gloves; (7) ability to test sleeves; (8) automatic maintenance of tank water level; (9) freedom from "bugs" in testing.

Available power supply was from a transformer with control panel. The transformer was rated at 10 kva at either 19,050 v or 33 kv. Low voltage input ratings were 115, 132 or 230 v. This afforded 5.25 kva continuous rating at 10 kv, or, at 0.2 kva per glove specified by ASTM, capacity for 26 gloves. However, for an anticipated total test load of under 50,000 gloves annually, a 20-glove testing unit was deemed to be of sufficient capacity.

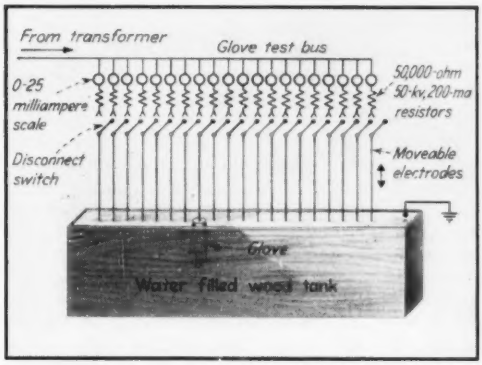
Control is through a Variac on the panel. The latter also carries a voltmeter, milliammeter, energizing



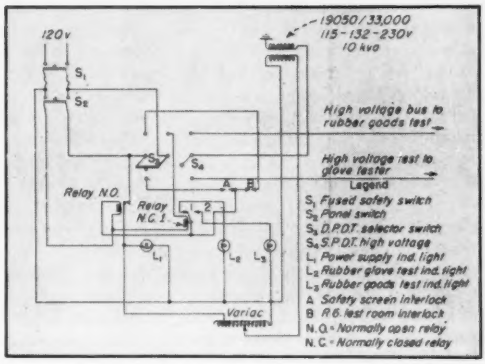
2 **SAFETY SCREEN CLOSED** and all is in readiness for testing. Twenty gloves can be tested at at time



3 **CLOTHES-PIN HOLDERS** permit the gloves to be flexible. Thus, water in glove approaches the level of water in tank



4 **ARRANGEMENT** of glove test circuits with respect to milliammeters, resistors, safety disconnect switches, and test electrodes



5 **SELECTOR SWITCH** supplies test voltages to either glove test or rubber goods test. Safety screen interlocks are A and B

switch and an overload protective device. As individual milliammeters were installed on the testing assembly, the switchboard milliammeter is not used. Transformer output can be switched (1) to the rubber glove tester bus or (2) to the rubber goods test room for checking blankets, hose, and hoods.

The glove tester bus is located 8 ft above the floor. From this, lead drops are made to the individual 25-ma ammeters in the glove test circuits. Before acceptance these instruments were tested to withstand 300% overload for 30 sec. Their scale in the 5 to 10-ma range is considered satisfactory for glove use. After installation it was necessary to shield the meter cases to avoid errors due to electrostatic field. From the milliammeter the individual glove circuit is to a knife switch with a 26-in. impregnated wooden handle provided with a rubber bicycle handle grip. These switches enable de-energizing a failed glove or opening extra glove circuits when less than a full complement of 20 gloves is being tested.

From the knife switches the individual circuits drop to 50,000-ohm resistors. These limit short-circuit current through the meters to 200 ma if a glove fails. The normal voltage drop through these resistors is 400 v, due to a current of 8 ma. Thus, from this effect, the actual bus potential is set at 10,400 v. Glove leakages vary from 6 to 10 ma; hence the maximum error in applied potential that can occur is 100 v. In other words, with the 50,000-ohm resistor, a bus potential of 10,400 v and glove leakage currents of between 6 and 10 ma, the actual glove potential will range between 9,900 and 10,100 v, which is considered satisfactory.

The most important feature of the new test unit is the automatic insertion and removal of electrodes. The 20 brass electrodes are connected to the bottom of the resistors by brass chains through which are threaded flexible copper wire. The chains provide the weight to prevent flapping, the wire insuring proper conductivity. The electrodes are supported 6 in. from the rear of the safety screen by insulators bolted to the screen. The electrodes are so fixed in location that when the screen is lowered they automatically enter the positioned glove in the tank. This does away with placing 20 electrodes individually and manually into the gloves for testing and afterwards removing them manually from the interior of the gloves. Milliammeters, switches, resistors and electrodes are primarily insulated from the ground by 45-kv insulators. In addition, knife switches, resistors and electrodes are mounted on impregnated wood for insulation between circuits.

CONTINUED ON NEXT PAGE

Meters are mounted on plywood.

The glove tank is constructed with an automatic float and overflow. Glove support is by clothespin holders similar to those used on other testers. An improvement was made, however, by cutting a 1¾-in. diameter hole in the holder for quick placement in addition to the notch at the top for actual support and the accurate positioning required for automatic insertion of electrodes. The tank is of 2-in. cypress with inside dimensions of 135 in. x 22 in. x 10 in.

Correlation of insulation and meter location is important to insure that only the leakage current through the glove is measured. In a structure of this size, leakage currents over insulators or between circuits may cause serious errors in readings. Therefore, board leakage current accuracy was calibrated by comparing readings of the 20 individually mounted milliammeters with a precision instrument temporarily inserted in each glove circuit directly at the glove. Similarly, to establish 10 kv across the glove it was thought necessary to use a static voltmeter or make corrections for the lagging current of a potential instrument transformer. Again, as the rubber gloves draw a leading current, the rise of voltage through the transformer changes the test voltage in proportion to the number of gloves being tested, and if voltage is obtained at the "low side" corrections must be made. All of these sources of error were investigated in order to determine how measurements should be taken and what accuracy could be expected. It is considered that the milliammeters as mounted with voltmeter calibration as now set will give results within plus or minus 7%, or about 0.05 ma for the average glove regardless of number being tested.

Difference in water level between the inside and outside of the glove under test as well as "wet" cuffs were known to result in so-called "corona cutting". In the tank, cuff exposure above the waterline is the 1.5 to 2-in. specified by the ASTM. The clothespin holders permit the glove to be flexible in the water. Consequently the water inside the glove automatically attempts to adjust itself to the water level in the tank. For this reason the amount of water in the glove is not critical.

Cuffs are dried by a fan at the end of the tank. Wet cuffs result in surface leakage over the cuffs.

An annual test load of 50,000 cuffs means about 200 cuffs per work day. Actual energized test time for 200 gloves at 3 min test for each 20 gloves is thus only 30 min per day. This allows ample time for cuff drying and avoids the electric test facility's becoming a bottleneck.

A metal drain tank is located immediately in front of and is attached to the cypress water tank. The purpose of this drain tank is to obtain a "ready" position for gloves to be tested and a drain for the wet and tested gloves. Operating procedure calls for the water in the tested glove to be poured into the "ready" glove. After emptying, the tested glove is temporarily placed in the drain and the "ready" glove placed in position.

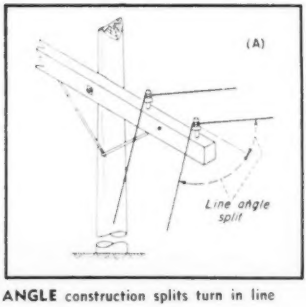
The question of checking other laboratory tests brings out the interesting point that rubber does absorb moisture. One engineer reported, from several years' experience, that the average difference between winter and summer readings on the same glove amounted to over 1 ma, or 15 to 20% variation. Gloves left overnight in water may show typical changes in leakage current from 0.5 to 1.6 ma. Hence, humidity conditions as well as individual glove testing equipment errors must be considered in comparing leakage values.

The safety screen meets Massachusetts requirements. It is interlocked with the primary current and has two danger lamp indicators. The tank is emptied each Friday night and refilled Monday AM with tap water with disinfectant added.

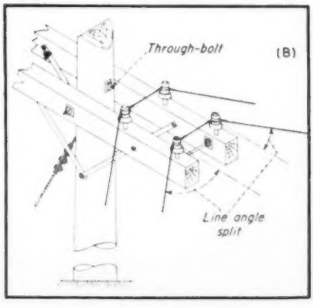
How To Install Angle Construction

HARTFORD (Conn.) Electric Light Co has set up useful methods of angle layout on primary circuits for both single and double-arm service. Sketch (A) shows the single-arm construction and (B) the double-arm set-up. Arms split angle of turn in the line.

On angle poles using one crossarm, the wires are tied on the side of the insulator so that the strain will be against the insulator and not on the wire. If the unbalanced load in double-arm construction exceeds 4,500 lb, a through-bolt is used to prevent splitting of the pole. In the table of angle pull in feet, allowed values are based on 500 lb for wooden and 1,000 lb for steel pins.



ANGLE construction splits turn in line



Wire Sizes and Angle Pulls for Single and Double Crossarms

Type of Pins	Wire Size No.	Crossarms	Angle Pull, Ft
Wooden	4 and below	Single	0-26
Wooden	2	Single	0-17
Wooden	0	Single	0-12
Steel clamp	4 and below	Single	27-50
Steel clamp	2	Single	18-33
Steel clamp	0	Single	13-23
Wooden	4 and below	Double	0-50
Wooden	2	Double	0-33
Wooden	0	Double	0-26
Steel clamp	2	Double	34-50
Steel clamp	0	Double	26-47

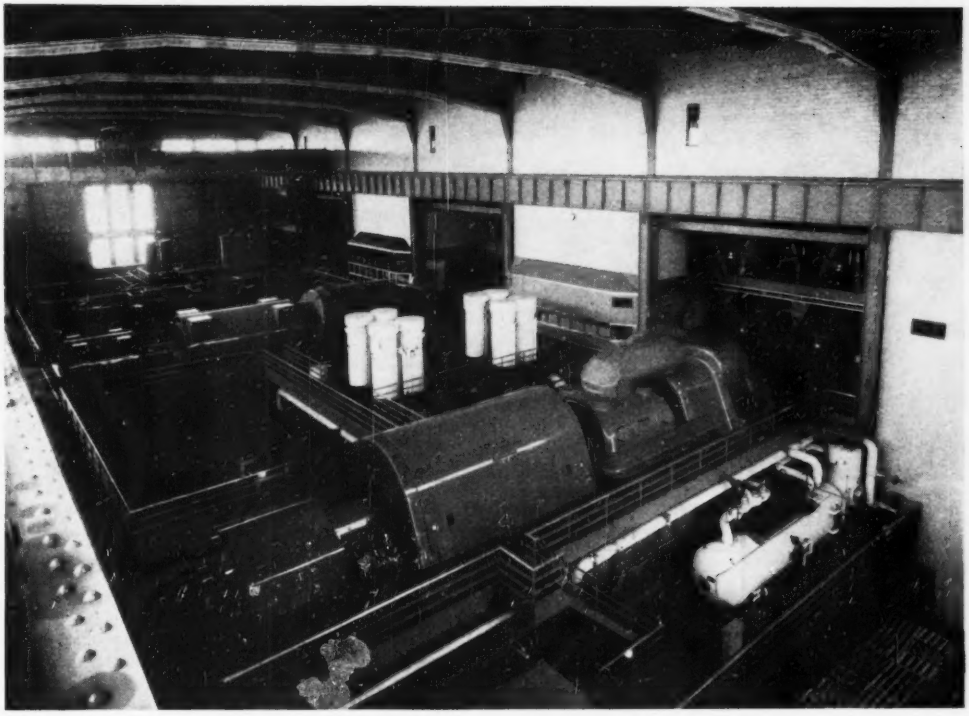


FIG 1—TURBINE-GENERATORS No. 1 and 2 at Sewaren; No. 3 and 4 to be installed at far end. Unit system (one boiler-one turbine) contributed to relatively low first cost of station. Three operators control one pair of units. Lighting fixtures are on bottom of beams

Sewaren Adopts 1050 F Steam

Station arrangement with central control simplifies operations and minimizes manpower per kw . . . Improvements in calculated heat rates shown for progressive steps of program . . . All auxiliaries have electric drive

DESIGN OF SEWAREN Generating Station aims to develop the unit system (one boiler serving one turbine-generator) to the greatest extent practicable. Principal operating features are: throttle steam conditions of 1,500 psi and 1,050 F in three non-reheat 100 Mw units with reheating to 1,000 F in the fourth, a 125 Mw unit; semi-outdoor boilers at latitude north 41 deg; two-level steam-side operation; and central control of boiler-turbine units in pairs.

Development of innovations and principles at Sewaren was a logical evolution from the installation of the 100 Mw unit at Essex station. Among the features of that unit are a 3600-rpm single-shaft machine, hydrogen pressure of 25 psi, shaft-end house generator, all-electric auxiliary drives and center-tap reactor to limit breaker duties (see EW, March 26, 1949, page 95).

To meet the system load as forecast for 1948, construction was authorized for Sewaren station with two nominally rated 100 Mw units (Fig 1). These units were in operation by December 1, 1948. Because of the rapid growth of load on the system, a third unit was authorized. It is a duplicate of the second unit and is scheduled to be in commercial operation in the late autumn of 1949. A fourth turbine-generator is on order for installation early in 1951. No. 4 is similar to the first three units but it will be rated at 125 Mw.

Upon completion of the four units, Sewaren Generating Station will have an installed capability of at least 450,000 kw, and the total system capacity will then be 1,615,300 kw.

Present estimated unit cost of the four-unit station is $132 per net kw for nameplate conditions. This amount includes all electrical equipment to high voltage side of main

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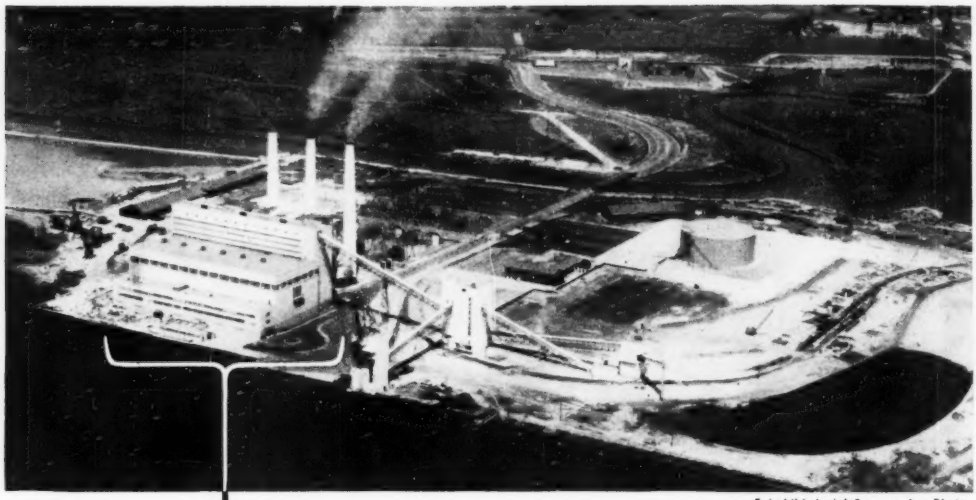

Fairchild Aerial Surveys, Inc Photo

FIG 2—SEWAREN GENERATING STATION transformer yard, coal handling buildings, coal and fuel storage; also switching station (center top) for supply to local territory

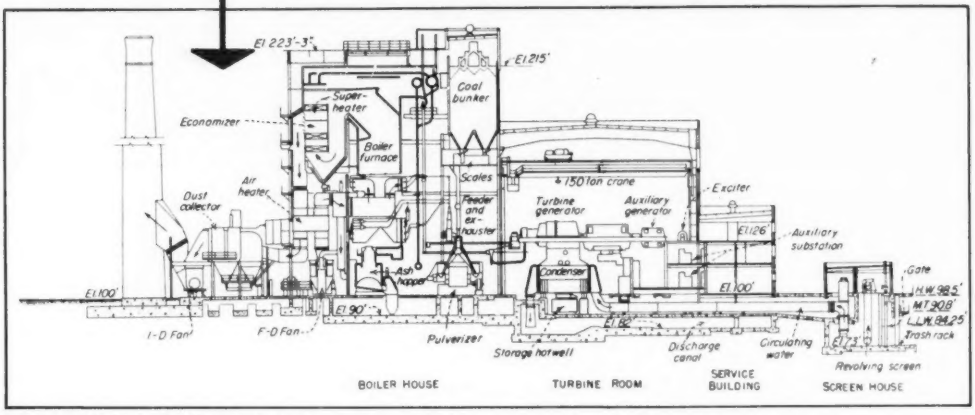

FIG 3—STATION CROSS-SECTION. Operating floors are located at elevations of 100 ft and 126 ft

Sewaren capability will be at least 450,000 kw

transformers in the adjacent yard.

Sewaren will be the largest of the five major generating stations which serve the Public Service system. The station site (Fig 2) is in the Sewaren section of Woodbridge Township, N. J., on the Arthur Kill.

For two-level operation the turbine-generators and exciters and the control room are on the upper level (126-ft elevation); the auxiliary equipment is laid out on the lower operating floor (100-ft elevation), as near ground level as possible (Fig 3). The circulating water pumps are at the screen well. Forced draft and induced draft fans, air preheaters and dust collectors are out of doors. Pulverizers for each boiler are placed under its coal bunker. The stacks are on separate foundations. The layout results in a plant spread out horizontally.

Semi-outdoor Boilers

Sewaren boilers are the semi-outdoor type. The building encloses the front and part of one side of each boiler. Form of the building in the vicinity of the boilers is shown in the simplified sketch, Fig 4. This type of construction saved approximately $1 million in first cost of three units. Because of smaller building volume and reduced heat radiation in the boiler house, the building is easier to ventilate and keep clean.

Since the design objectives included the semi-outdoor feature, two-level operation and the utmost simplicity, the area occupied by the steam generator and auxiliaries is roughly 160 ft x 50 ft. The drums, superheater outlet headers and downcomers are offset from the furnace so

that they are housed in the building. This facilitated the semi-outdoor design of the boiler.

Each of the first three Sewaren boilers is of the three-drum, radiant type, having a continuous rating of 850,000 lb per hr and a maximum of 950,000 lb per hr for 4 hr with throttle conditions of 1,500 psi and 1,050 F. The fourth boiler with reheat will be of similar construction and have a continuous rating of 865,000 lb per hr.

The slag-tap furnace is arranged for tangential corner firing with pulverized coal and oil. The burners are vertically adjustable to obtain optimum slagging conditions and some superheat control. Final steam temperature is controlled by a bypass damper.

Turbine-Generator Design

First three turbine-generators are single-shaft, tandem-compound, 3600-rpm units with a nominal rating of 100,000 kw at throttle steam conditions of 1,500 psi and 1,050 F. A 7,500-kw generator for auxiliaries is connected to the outboard end of each generator. Excitation is provided by slow-speed motor-generators.

No. 1 turbine is essentially similar to No. 1 turbine at Essex Generating Station, which has throttle steam conditions of 1,250 psi and 1,000 F. No. 2 and No. 3 units are twin machines. No. 4 unit will be similar to No. 2 and 3 units except that it will be rated 125,000 kw with steam reheated to 1,000 F. Calculated plant heat rate for the units are shown in Fig 5. At this station a kilowatt-hour is produced from 0.75 lb of coal.

Ratings of the first three generators at 13.8 kv are shown in Table I.

Steels used in the pressure-parts exposed to the highest temperature are listed in Table II.

The fourth main generator will have a rating of 140,000 kva at 16.5 kv. With this higher operating voltage, the current will be about the same as that of the other units. The main leads and other current carrying parts associated with all generators will be identical.

The 7500-kw auxiliary generators are air-cooled in closed systems having surface-type coolers with condensate as the coolant.

Central Control

Unit design, with only one boiler per turbine, greatly facilitates central control. At Sewaren there are 521 sq ft of panel in one location; at Burlington (1943) there are 695 sq ft in five separate locations. This concentration of control results in better coordinated operation and a reduction in operating attendance. Each of the two control rooms is situated at the center of the area occupied by the main equipment under its supervision.

Each control room is T-shaped, with the electrical bench board (Fig 6) forming the cross-bar. The operator sees the two turbine-generators through windows just between the bench board and raised instrument panels. The sides of the room are occupied by the panels controlling the turbines, boilers and their auxiliaries. At the rear, two windows provide a view toward the boilers.

Three operators are in the air conditioned and sound-proofed control room. Normally one operates the electrical bench board of two units, and each of the other two operates the mechanical equipment of one unit. Operators are trained to handle both mechanical and electrical controls, and rotate on the three jobs.

Special attention was given to the lighting, particularly of the vertical panels. Totally indirect lighting is provided by means of a cove and

TABLE I—Ratings of First Three Main Generators

Generators, 13.8 kv	No. 1	No. 2 and No. 3
Nominal rating, kw	95,000	95,000
kva	111,765	111,765
Power factor	0.85	0.85
Hydrogen pressure, psi	15	15
Maximum rating, kva	121,176	117,647
Hydrogen pressure, psi	30	25

TABLE II—Steels Used in Pressure Parts Exposed to 1050 F Steam

Pressure Parts	Steels Used in Unit No. 1	No. 2
Superheater Tubes	19% Chromium 11% Nickel Titanium stabilized	19% Chromium 11% Nickel Titanium stabilized
Steam Piping	3% Chromium 1% Molybdenum	3% Chromium 1% Molybdenum
Turbine Valves	18% Chromium 8% Nickel Columbium stabilized	17% Chromium 14% Nickel 2% Molybdenum Columbium stabilized
Turbine Cylinder	2-1 4% Chromium 1% Molybdenum (See Note)	17% Chromium 14% Nickel 2% Molybdenum Columbium stabilized
Turbine Buckets	13% Chromium	12% Chromium 5% Cobalt 3% Tungsten 0.15% Molybdenum

Note: The entering 1050F steam does work in an impulse element and its temperature is reduced to 970F before it is in contact with the 2 1/4% chromium-1% molybdenum turbine cylinder.

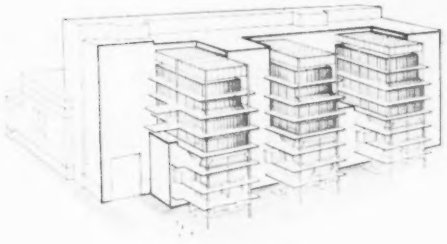

FIG 4—SEMI-OUTDOOR BOILERS saved construction cost

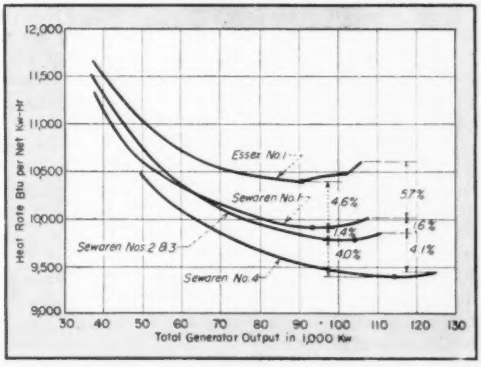

FIG 5—CALCULATED HEAT RATE, Essex No. 1 and Sewaren units

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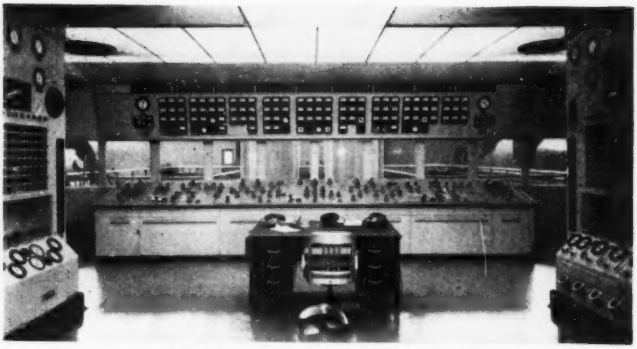


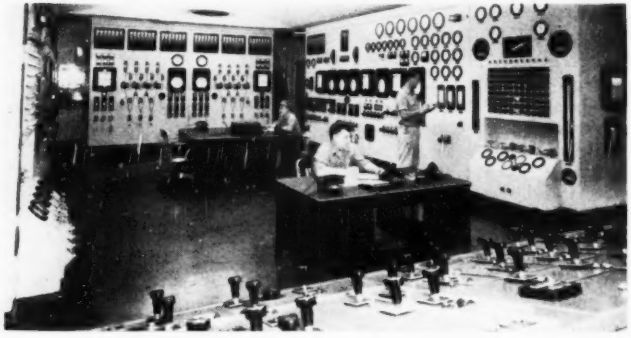


FIG 6—CONTROL ROOM for No. 1 and 2 turbine-generators. With practically all station instruments and control devices in a central location, three men can operate each pair of generating units. (Above) Electrical section. Glareless glass used in windows between bench board and raised instrument panels. (Below) Mechanical section for boilers, turbines and their auxiliaries

arched ceiling design. In the areas between sections of the arched ceiling, eggcrate plastic was used to provide a luminous ceiling. An intensity of 40 ft-c is obtained on the lower panel sections.

Auxiliary Power

Shaft-end auxiliary generators provide the essential auxiliaries with a direct source of power free from outside disturbances. Normally each auxiliary generator carries the essential auxiliaries of its own unit. It is rated 7,500-kw at 2,400-v, 80% power factor, and is separately excited. The 2,400-v auxiliary buses of each unit can be fed either from the auxiliary generator or from auxiliary transformers connected to an outside source. The two are never paralleled. Relays are installed to throw over automatically from generator to transformer in case of loss of voltage on the generator. Manual throw-over in the other direction is provided for transferring auxiliaries from transformer to auxiliary generator when starting.

All auxiliaries are electric motor driven. Steam for heating fuel oil, mixing chemicals and heating the building is supplied normally from the evaporators. A heating boiler was installed for use in the event of a complete station shutdown.

With the shaft-end auxiliary generator as the source of auxiliary power, the elimination of steam-driven auxiliaries becomes a relatively easier step in station design. One of the problems in this connection was the substitution of motor-driven, positive displacement, rotary vacuum pumps for the usual steam jet ejectors for the removal of non-condensible gases from the condenser.

The traditional steam-driven auxiliary oil pump of the turbine-generator was replaced by a full capacity a-c motor-driven pump backed up by a smaller d-c motor-driven pump operating from the station battery. This latter pump has sufficient capacity to bring the turbine-generator to a stop if both main and auxiliary pumps should fail.

Principal Electrical Features

Ultimate connections of the four Sewaren generators to the system are shown in Fig 7. Each generator feeds into the mid-point of a reactor which takes the outgoing current into two channels. All switching is done between the generator and transformer at 13-kv, except for one 132-kv oil circuit breaker which ties together two lines, closing a transmission loop when the station is shut down. The 26-kv circuits from Sewaren Switching Station feed the area adjacent to Sewaren while the 132-kv lines connect to the transmission system.

The 13-kv generator leads in 8-in. pipe-type cables extend about 525 ft in tunnels (Fig 8) to the transformer yard. The pipes are mounted on foundation slabs carrying station power and control cables in one case, and transformer track supports in another case.

Placing the Oilostatic cables in tunnels enabled the use of forced cooling, by means of which the aggregate copper cross-section of the conductors was reduced from 12 million to 6 million cir mils per phase, thus effecting a saving in cost and permitting the use of small, easily handled cables. Forced air is used to cool the pipes in No. 1 and 3 tunnels. For generator No. 2, the oil itself is circulated by a pump and gives up its heat in an oil-water heat exchanger. The forced cooling is required only in hot weather. Each generator has 24 750,000-cir mil Oilostatic cables, six in each pipe.

In the transformer yard the Oilostatic potheads are connected by overhead bus to the mid-point of duplex reactors which are housed in a masonry structure. Transformers, circuit breakers and other equipment are indicated in Fig. 7.

Aluminum bus was adopted for the transformer yard after a study showed considerable savings in its installation. Fig 9 shows portions of the 132-kv bus which is round. The 13-kv buses are rectangular, some are tubular and others are formed from two angle sections. A large portion of the savings lies in the use of the newly developed inert gas shielded

arc system of welding in lieu of the usual bolted connections. This is the first installation made using inert gas shielded arc welding on outdoor buses of such heavy cross section.

Isolated phase bus leads run from the auxiliary generator to the 2400-v service buses.

Motors rated at 200 to 2000 hp are supplied at 2400 v; those between 25 and 200 hp at 440 v; while those below 25 hp are fed at 220 v. These latter motors and the station lighting are supplied by air-cooled, transformer load center units.

The light intensity in the turbine room (See Fig 1) is approximately 30 ft-c at the upper operating floor level. Combination incandescent-fluorescent units are mounted flush against the bottom flange of the arched girders or roof beams. The units form a continuous fixture containing 16 500-w incandescent lamps with control lenses and 64 40-w fluorescent tubes. Lighting load is about 10 kw per beam. Relamping and cleaning are done from the top of the 150-ton crane.

Information for this article was supplied by F. P. Fairchild, Chief Engineer, Electric Engineering Dept, E. H. Snyder, H. Weisberg and P. A. Salmon, all of the Public Service Electric and Gas Co.

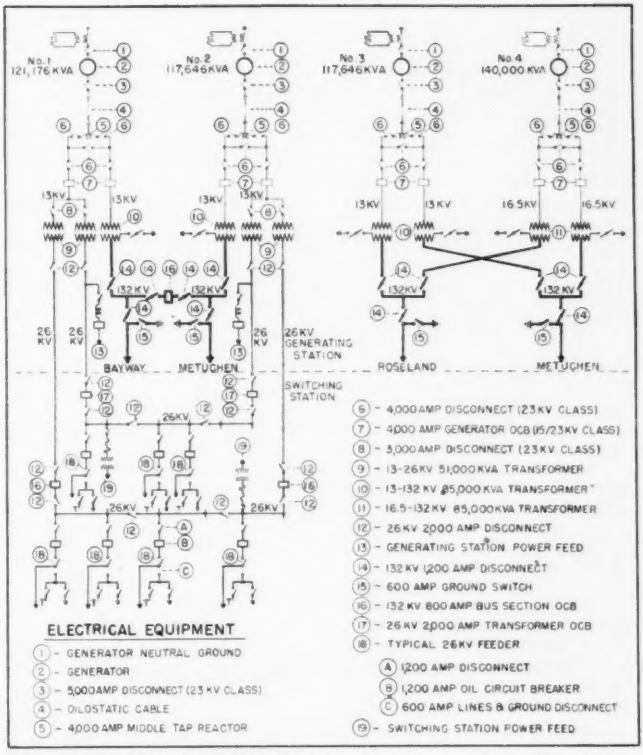

No.1 121,176 KVA
No.2 117,646 KVA
No.3 117,646 KVA
No.4 140,000 KVA
13KV
16.5KV
132 KV
26 KV
26KV GENERATING STATION
SWITCHING STATION
BAYWAY
METUCHEN
ROSELAND
ELECTRICAL EQUIPMENT
1 - GENERATOR NEUTRAL GROUND
2 - GENERATOR
3 - 5000 AMP DISCONNECT (23 KV CLASS)
4 - OILOSTATIC CABLE
5 - 4000 AMP MIDDLE TAP REACTOR
6 - 4,000 AMP DISCONNECT (23 KV CLASS)
7 - 4000 AMP GENERATOR OCB (15/23 KV CLASS)
8 - 3,000 AMP DISCONNECT (23 KV CLASS)
9 - 13-26 KV 51,000 KVA TRANSFORMER
10 - 13-132 KV 85,000 KVA TRANSFORMER
11 - 16.5-132 KV 85,000 KVA TRANSFORMER
12 - 26 KV 2000 AMP DISCONNECT
13 - GENERATING STATION POWER FEED
14 - 132 KV 1200 AMP DISCONNECT
15 - 600 AMP GROUND SWITCH
16 - 132 KV 800 AMP BUS SECTION OCB
17 - 26 KV 2000 AMP TRANSFORMER OCB
18 - TYPICAL 26 KV FEEDER
A 1200 AMP DISCONNECT
B 1,200 AMP OIL CIRCUIT BREAKER
C 600 AMP LINES & GROUND DISCONNECT
19 - SWITCHING STATION POWER FEED

FIG 7—ULTIMATE CONNECTIONS of four Sewaren generators to the system

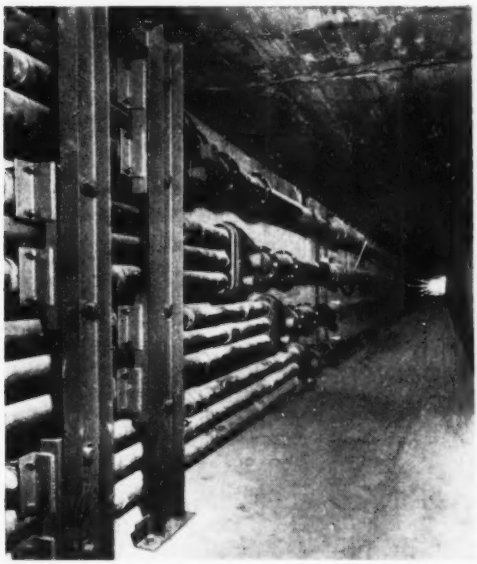


FIG 8—OILOSTATIC CABLE extends 13-kv generator leads through tunnel to reactor in transformer yard

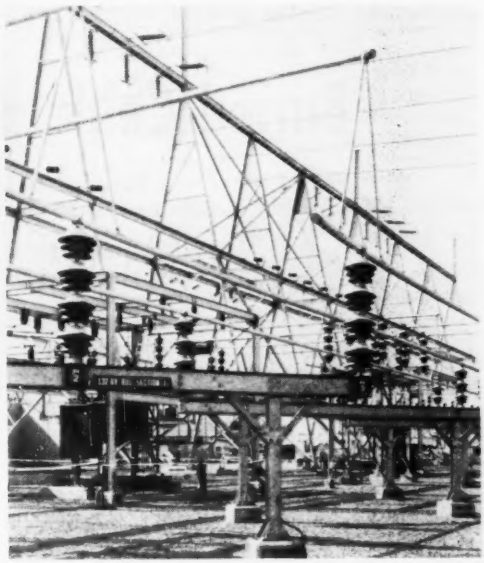


FIG 9—ALUMINUM BUSES are square for 13-kv circuits and round (shown) for 132-kv circuits. All joints are welded

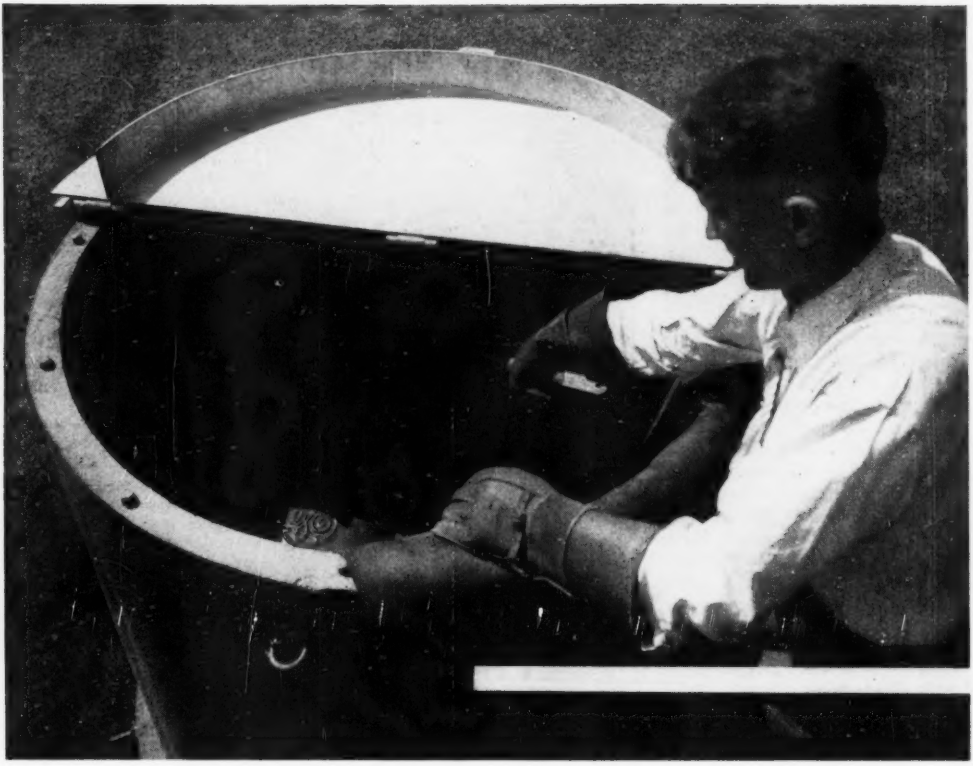


FIG 1—OVERHEAD-TYPE TRANSFORMERS installed aboveground in specially constructed concrete tiles, 4 ft high and 4 ft in diam, set 1½ ft into the ground. A porcelain box disconnect was installed in some of these vaults for sectionalizing primary cable

Buried Cable Bridges Gap Between

Scheme resembles overhead and can be operated by personnel trained for overhead system work. Although more costly, operating costs will be lower, interruptions fewer

A. D. CASKEY, Electrical Engineer
F. E. ANDREWS, Engineer, Transmission and Distribution Design
Public Service Co of Northern Illinois

IN A PREVIOUS article, development of methods of plowing in cables on rural distribution lines and transmission circuits was described. After equipment was developed for installation of cable in this manner, and following several years of successful operation of rural distribution lines with primaries consisting of concentric cable buried directly in the ground, it was decided that this type of installation could be adapted to selected urban, residential area distribution. This presented problems of secondaries, transformer installations, requirements of greater service continuity and installation of services, not encountered in the rural installations.

Rural experience led to consideration of buried cable for urban service. For secondaries in these areas, 600-v, moisture-resistant, rubber-insulated Neoprene-jacketed, non-me-

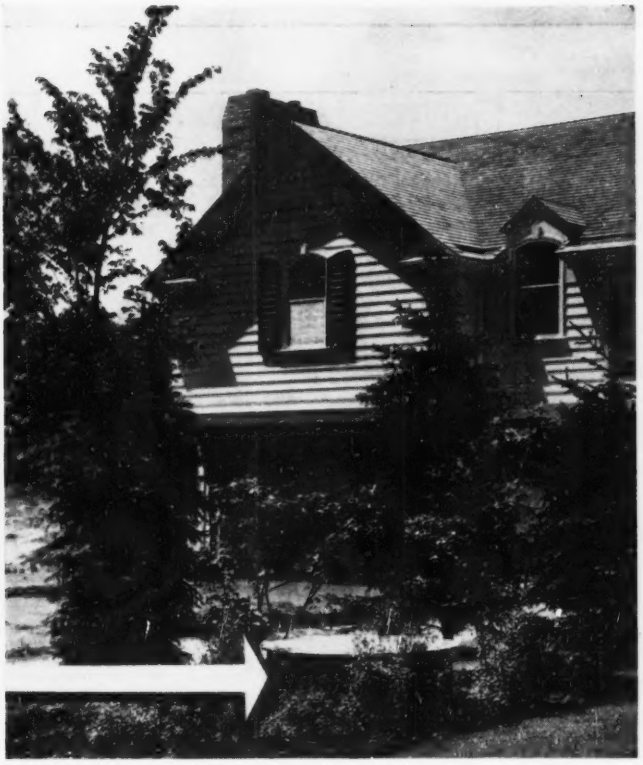


FIG 2—TRANSFORMER INSTALLATIONS in residential areas are hidden by landscaping or otherwise built to blend with architecture. Parkway location near curb is preferred

Overhead and Underground

tallic sheath cables were selected. These were buried in the ground along with a bare soft-drawn copper wire for the neutral on the secondary system. Use of a combined primary and secondary neutral, in order to obtain the maximum advantage of the multi-grounded system, was studied. However, for safety reasons, it was concluded that the proposed system should have separate multi-grounded neutrals, interconnected wherever practical.

In order to keep down cost and simplify operation, overhead type transformers were installed in above-ground enclosures, eliminating the expense of elaborate underground transformer vaults and the cost of subway type equipment. Internal primary fuses and secondary breakers eliminate the conventional external fuse cutout and the need for periodic load checks. Furthermore, the secondary breaker provides protection from secondary cable failure as well as sustained overload.

For the smaller single phase transformers, above-ground vaults, Fig 1, consist of specially constructed concrete tiles, 4 ft high and 4 ft in diameter, placed 1½ ft into the ground. They are set on precast concrete bases and have sheet steel covers. A porcelain box disconnect for sectionalizing one primary cable may also be installed in these vaults. Larger transformers, or three phase banks, are installed in a sectional type of prefabricated vault with steel doors. They are built up from concrete corner posts and concrete slabs. The vaults are assembled by bolting together in the field and may consist of one or more sections to provide the size needed.

Landscaping

Various methods have been employed in landscaping around such enclosures to hide them where local conditions required their installation in front of homes. In one case, flagstone was built up around the vault, and by the use of stained timbers and an old bucket, a deep well effect was created which blended perfectly with the architecture of the area. Consideration is now being given to specially designed transformers which can be buried directly in the ground and protected with a manhole cover which would also provide a means of access to the transformer.

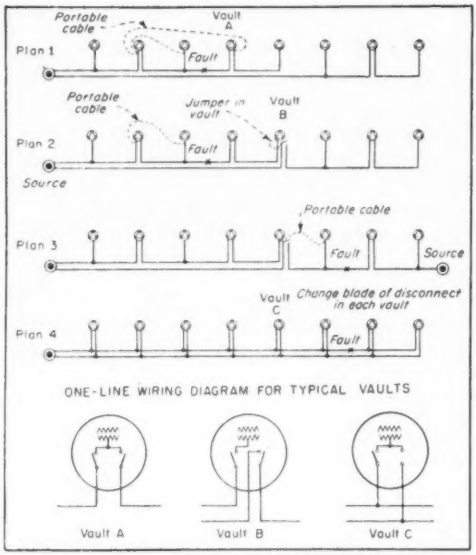
Preliminary considerations indicated that the preferred location for cables, transformers and associated equipment was on the rear lot line so that the above ground enclosures could be screened off by suitable landscaping. However, after further study it was concluded that the underground cables, and the above ground enclosures should be located in the parkway between the street curb and sidewalk. At the present time, there are three major developments in the process of construction in which the simplified low-cost underground distribution system is being installed.

Park Forest Community

Largest of these is the Park Forest development, south of Chicago, which will be a completely new city, to ultimately consist of about 8,000 dwelling units, enough to house 25,000 to 30,000 people. Part of this project is already in service.

In this development, alleys have been eliminated, and curvilinear streets will divide the area into irregular blocks some as large as 54 acres. Buildings of more than two units are grouped about parking areas, and to avoid monotony, many different grouping arrangements, around areas of different shapes, are

FOR SYSTEMS CONSIDERED IN PARK FOREST DEVELOPMENT—TURN PAGE



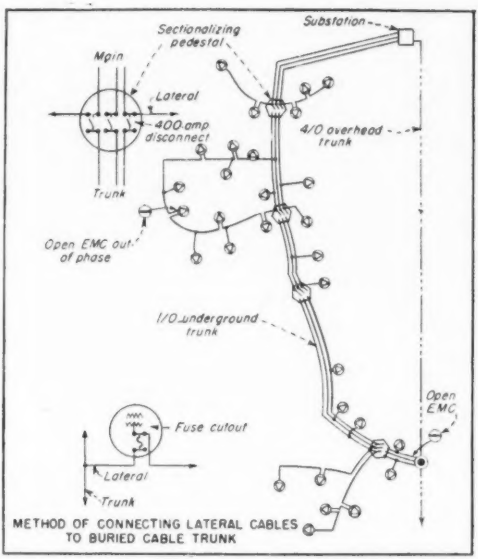


FIG 3—FOUR PLANS of primary circuit layout were considered for the Park Forrest community: 1—Simple radial type, no reserve; 2—Modification of Plan 1 with limited reserve feed arrangement; 3—Second source of feed added to Plan 2; 4—Completely different design which supplies normal and emergency feed to each transformer **FIG 4—DIAGRAM** of plan adopted for Park Forest Development

BURIED CABLE (continued)

being used. Groups of duplex units are built along the streets. The first 3,000 units will require approximately 70,000 conductor feet of primary cable and 150,000 ft of secondary cable.

Total ultimate load for the first 3,000 units has been estimated at 2,500-kva—2,000-kva for residential load and 500 kva for commercial, street lighting, and water pumping loads.

To handle this initial load a No. 4/0 copper overhead feeder trunk was built along a public highway through the area and a No. 1/0, 2/C, 5-kv concentric cable was buried in the parkway of a private street paralleling the highway. Lateral circuits consisting of one, two, or three No. 6, 2/C, 5-kv concentric cables, buried in the street parkway and along drives in parking areas, are tapped to these feeder trunks. Lateral cables connected to the overhead trunk are fused off conveniently and economically on the cable riser pole. Because of the relatively low failure rate of concentric cable, and the additional cost of equipment, fusing of cable laterals from the underground trunk could not be economically justified.

Four basic plans were analyzed on the basis of cost, expected customer-minutes interruptions per year, and the extent to which portable emergency cables would be needed to restore service. One feature common to three of the plans is that the cables are alternately looped and tapped into successive transformers. This was found practical and economical in Park Forest where most transformers are located from 50 to 400 ft from the street.

Four Plans Considered

The four plans considered are shown in Fig 3. Plan 1 is a simple, radial type layout, which provides no reserve. The number of cables used and the length of each are determined solely on the basis of voltage drop and current-carrying capacity. Depending on the location of a fault and the number of cables involved, service can usually be restored to some of the customers by disconnecting the faulted cable section. Service to remaining customers requires the use of one or two portable emergency cables, which from a practical point of view, have been limited in length to 1,000 ft.

Plan 2 is a modification of Plan 1 which will very much improve the performance in case of failure of a single cable but gives only slight improvement for a multi-cable fault where there are two or three cables in the trench. By sectionalizing the longer cable in the last vault on the shorter cable, a reserve feed is made available for all but a few transformers on the single-phase portion of the lateral. The cost of converting Plan 1 to Plan 2 is low since all that is needed is a sectionalizing disconnect and the extra cable to loop in and out of the last vault.

Plan 3 is the same as Plan 2 but with the addition of a second source of feed to the longest cable. It provides reserve for the customers served from the single-phase portion

of the lateral of Plan 2 and in addition furnishes reserve in case of a multiple cable failure. With this plan not more than two transformers are dependent on emergency cables for faults involving one or more cables.

Plan 4 represents a completely different design which provides for a normal and emergency feed to each transformer. It supplies 100% reserve for single cable failures but in the case of multi-cable faults, all customers would be without service until the cables are repaired.

Costs vs Benefits

The choice of plan depends on the relation between the incremental cost for additional refinements and the benefits that can be expected from the refinements. In the case of Park Forest, Plan 2 was adopted as the basic design with the stipulation that where a second source of feed could be made available at only a small increase in cost, Plan 3 would be used. It so happened that for two laterals, the increase in capacity added by a second source of feed permitted savings in cable and sectionalizing equipment that equalled the cost of supplying this additional source of feed.

In order to limit the number of customers for whom no reserve is provided, except by use of portable cables, it was decided that, in general, not more than 75 customers or three transformers would be served from the single-phase portion of the cable. To keep within this limit, it was necessary in some cases to extend the shorter cable beyond the point required for voltage drop alone.

Each lateral cable connected to the underground trunk is looped through the transformer enclosure nearest the trunk and a fuse cutout replaces the sectionalizing disconnect at this point to provide protection to the lateral. In order to avoid prolonged interruptions to large groups of customers due to main-trunk cable failures, four above-ground sectionalizing pedestals divide the trunk into five sections. Laterals serving more than one transformer are connected to the trunk inside the sectionalizing pedestal or furnished with an emergency feed.

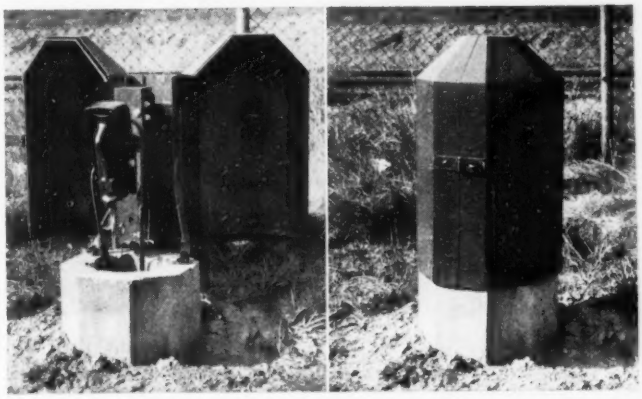


FIG 5—TWO VIEWS of above-ground sectionalizing pedestal

This will permit restoration of service to these laterals without using portable emergency cables, should one or more of the trunk cables fail.

No reserve is available for laterals supplying one transformer. This conforms to the general principle that no reserve will be provided for less than 75 customers. Not more than three of these transformers will be served from one section, each being connected to a different phase.

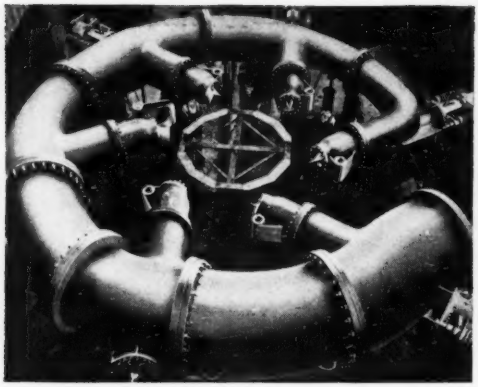
Secondary Design

Secondaries to serve the buildings of more than two units are generally looped around the parking area, although due to the irregularity of groupings, it is frequently necessary to extend short radial stubs from the loop. Groups of duplex units along the streets are served from radial secondaries installed in the parkway on one side of the street only. Secondaries are installed so that they can be reached by services run perpendicular from the buildings. The secondaries themselves consist of two No. 2, 1/C, 600-v rubber insulated Neoprene jacketed cables and a No. 2 bare copper neutral laid in a narrow trench 30 in. deep.

The secondary design was based on a coincident load of one kva per customer, a maximum load voltage drop of 3.5 v, and a maximum flicker voltage drop of 2%. The latter was selected to minimize the possibility of customer annoyance from frequent starting of the fractional horsepower motors on furnace fans with which all dwelling units will be equipped.

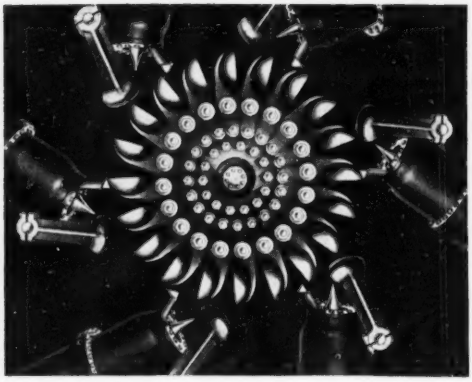
Services are installed, maintained, and owned by the builders. They consist of No. 8, 1/C, 600-v cable, similar to that used for the secondary, and a No. 8 bare copper neutral. For buildings around parking areas each 3-wire service will supply two customers with 2-wire, 120-v service. Each customer in duplex units along streets will have his own 2-wire service. The customer's service cable is connected directly to the secondary cable by means of a specially designed compression type Tee connector. The connector is so designed that it is not necessary to cut the secondary cable to make the connection. A short section of the cable insulation is removed, the connector is slipped around and pressed to the conductor with a compression tool, and the splice is then insulated with rubber tape.

The other two major residential installations are somewhat similar although not nearly as large or as extensive. Operating experience with these systems should indicate a more firm basis for future design and it is expected that the company will learn whether the anticipated advantages of lower operating and maintenance costs, especially in connection with severe storms, will justify more extensive underground distribution in residential areas.



Multi-jet impulse turbine . . .

Spiral distributor and nozzle body assemblies of the six-jet vertical impulse Pelton turbine, largest of this type ever built. Multi-jet design gives higher specific speeds at single jet efficiencies. This 62,000-hp unit is the first of ten projected units



with 12-ft steel buckets . . .

Turbine runner (from bottom of wheel pit looking straight up) is a plate steel center mounting 20 cast steel buckets with outside diameter of about 12 ft. Jet deflectors on trailing side of nozzles are part of governing system

Multi-Jet Impulse Turbines Show High Efficiency

Six-nozzle design provides higher specific speeds and affords high efficiencies of single-jet-per-runner design

J. L. CRELLIN, Hydraulic Engineer, Pelton Water Wheel Co, San Francisco

DEVELOPMENT OF operating efficiencies of multi-nozzle vertical impulse turbines, comparable to those of reaction types, has bridged a gap where neither the reaction nor the single-jet impulse turbine operates efficiently. Two such six-nozzle, 62,000-hp vertical impulse units, largest of this type ever built, are in satisfactory operation and a third is being installed in the Bridge River powerhouse of the British Columbia Electric Railway Co, Ltd. in southwest British Columbia. These units operate at 300 rpm under an 1,118-ft operating head at a specific speed (11.6) not efficiently covered by any previously accepted turbine design.

Specific Speed Principle

In selecting the proper type of prime mover for a hydroelectric plant, two basic factors must be considered—operating head and unit power output. Basic types of prime movers are the propeller or Kaplan type for low heads (100 ft and less), reaction or Francis type for medium heads (100–800 ft) and impulse or Pelton type for high heads (800–3,000 plus ft). With operating speed of the turbine a function of effective head and unit horsepower, selection of the proper turbine type has been simplified by the "specific speed" principle.

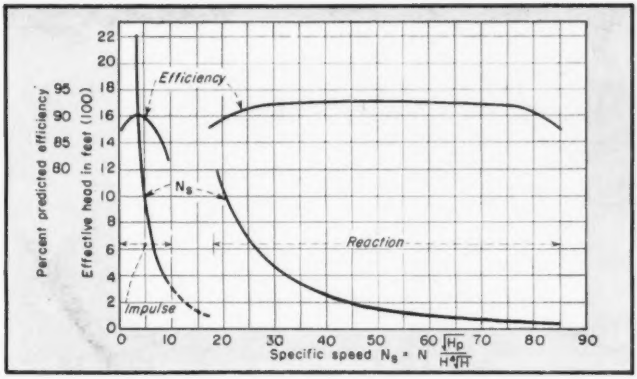
Specific speed is the speed at which a turbine would operate if its runner were reduced in size, without change in design, to the point where it developed 1 hp under 1 ft of head. The basic relationship is:

$$N_s = \frac{N\sqrt{H_p}}{H\sqrt[4]{H}}$$

where N_s is specific speed, N is actual operating speed in rpm based on system frequency, H_p is horsepower, and H is head in feet.

Some elements in turbine design respond most favorably efficiency-wise to a particular range of specific speed values. Specific speeds which are abnormally higher or lower than the normal range result in reduced efficiency. The head vs specific speed curve for the impulse turbine is based on the power of one jet applied to one runner. As shown in the accompanying curves, a specific speed above 7 for the impulse turbine or below 20 for the reaction turbine represents a marked decrease in efficiency.

The six-nozzle vertical impulse turbine permits higher specific speeds while maintaining the high values of efficiency shown on the curve for the single jet lower N_s range. Actual N_s of the Bridge River turbines is 11.6, but the single jet N_s for the same head and relative horsepower conditions is 4.75, which is near the point of maximum efficiency. Optimum design for a reaction turbine would have been a 60-cycle operating



bridges gap between other designs

Gap between high efficiency specific speeds of impulse and reaction turbines has been bridged by multi-jet design. Specific speed of 11.6 on six-jet design corresponds to 4.75 for single jet design, which is near maximum efficiency for impulse turbines. N_s based on single runner per turbine and for impulse turbine on single jet per runner

speed of 514 rpm and N_s of 20. The curves show that this N_s is approaching the abnormally low range, and efficiency is about equal to maximum efficiency of an impulse turbine with optimum N_s. Mechanical design limitations on the generator would probably have required a normal speed of 450 rpm or less for the 50,000-kva rating, giving an even lower N_s (17.5) and efficiency.

Efficiency

There has been some tendency in recent years to look favorably on higher speeds even at a sacrifice in efficiency, in order to reduce physical size and original cost. Loss in earnings of the overall project because of reduced efficiency must be carefully evaluated to determine whether such a reduction in initial investment is justified.

Maintenance of turbine operating efficiency over a long period of operation is another important factor deserving careful evaluation. Maintenance of reaction turbine efficiency requires maintenance of small design clearances between the runner and the stationary wearing surfaces. Such maintenance is costly not only in labor and material, but also in energy revenue lost during unit outage for inspection and overhaul.

Wear from silt has little effect on impulse turbine efficiency, since erosive action is limited to the needle point, nozzle seat ring and parts of the buckets. Use of stainless steel at these critical points slows erosion considerably. Years of experience have shown that an impulse turbine will perform satisfactorily and with little reduction in efficiency over a relatively long period without major maintenance. The long-term efficiency average of a reaction turbine may well be about on a par with that of an impulse turbine, since its higher initial efficiency does decrease with operation.

A reaction turbine loses its high efficiency rapidly at gate settings of 50% or less, but vertical multi-nozzle impulse turbine design, with individual controls on each nozzle, permits sustained high efficiency over a wide operating range. Such a turbine can be operated with good efficiency on any combination of one to six jets.

Another factor is the extra cost of excavation, forming and concrete work required for the reaction turbine draft-tube head regainer. This extra cost outweighs the value of head lost by setting the impulse wheel above tailwater, particularly if the fluctuation between maximum and minimum tailwater is small. Ease of access to the impulse turbine, making for simplicity of maintenance and easy replacement of worn parts, is also an important cost factor to be considered.

Extensive model tests were conducted in the hydraulic laboratory of the manufacturer and in the field to determine most efficient bucket design, fluid flow phenomena in the spiral distributor and nozzle bodies, and design of the runner housing. Data from the tests indicated a model efficiency of 89.8%, assuring satisfactory performance of the full size turbines.

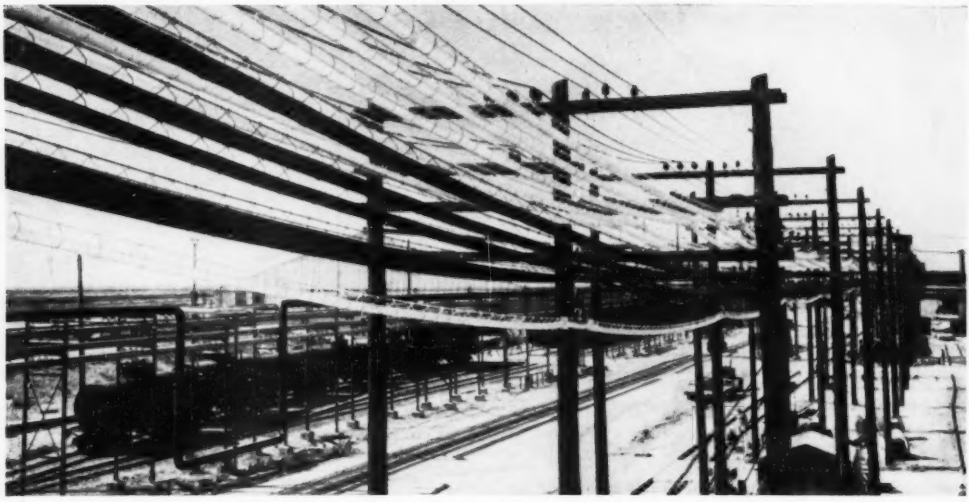
Governing-Control Equipment

Speed governing on the units is by a standard governor-operated jet deflector control with automatic needle follow-up. It is designed so the entire turbine load can be rejected in about 3 sec. The controller is adjusted, however, so that the needle closes at a slower rate to keep penstock surges within design limits.

Each needle nozzle is operated by its individual servomotor with direction and rate of motion of the needle regulated by the jet controller. Each jet controller is connected to the jet deflector system so that any motion of the deflector is transmitted to the controller. The controller is a cam and pilot valve mechanism which responds to movement of the deflector by porting oil under pressure to the needle servomotor to initiate a corresponding corrective movement of the needle. The deflector is adjusted for an equilibrium condition with the deflector edge just clear of the jet. As the load is changed the needle opening is adjusted accordingly by the controller so that no more water passes than is required.

The controllers may also be used to lock one or more of the needles in the closed position allowing operation at nearly maximum efficiency for reduced loads. A dashpot and compensating mechanism on the controller prevent hunting and aid stability. Heavy springs connected to the needle stems insure closure of the needle in the event of loss of servomotor oil pressure.

The turbine inlet valves are also noteworthy because of their design, which provides an unobstructed cylindrical passageway while open and complete closure with a 90-deg rotation. Previously designed spherical valves have used either floating plungers on the rotating part or movable sleeves on the stationary part to obtain tight closure.

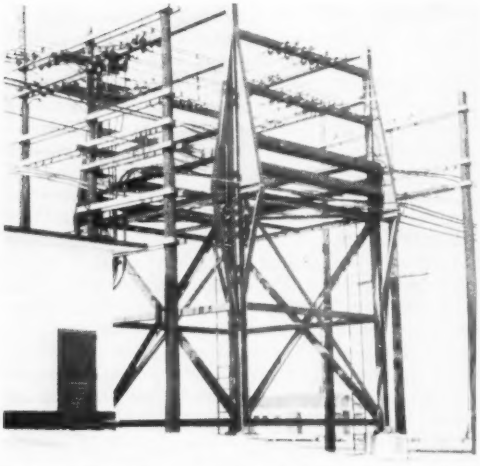


AERIAL CABLE SYSTEM distributes 15-kv primary power in Gulf coast plant. Some cables are painted white for test purposes

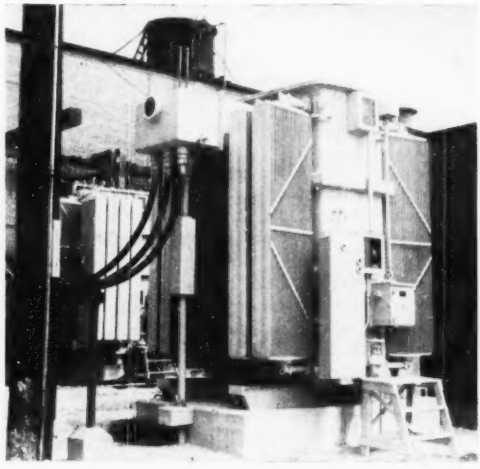
Aerial Cable Improves Industrial Service

Satisfactory eight-year service record of aerial cable system for 15-kv primary power in two chemical plants reveals low rate of 0.106 failure per mile-year for three-conductor cable. No failures in two years with improved single conductor cable

F. S. GLAZA, Supt. Electrical Dept., Freeport, Texas; **B. J. NANKERVIS,** Electrical Engineering, Velasco, Texas
Texas Division, The Dow Chemical Co



SELF-SUPPORTING tower withstands hurricane winds of 125 mph



TERMINATING CABLE at power transformers is simple and easy

BASED ON eight years of plant experience, rubber and synthetic-rubber covered cable for 15-kv aerial power distribution has proved entirely satisfactory for severe industrial service, such as required by Gulf coast chemical plants.

The Dow Chemical Company has at Freeport, Texas a large plant built beginning in 1940 for the production of magnesium, chlorine, caustic soda, ethylene, propylene, ethylene glycol, and other products. Also at Velasco, Texas, about 5 miles from Freeport, is another company plant.

These plants were constructed in the war years of 1940-1943 and, because of the processes involved, large amounts of power are used. Since the war the operation of certain magnesium metal facilities have been discontinued and other productions have been increased. The plants now require about 200,000 kw. With minor exceptions, the a-c power used in these plants has been distributed by an aerial cable system at 15 kv, grounded neutral, three phase, 60 c.

Insulated cable is used for power transmission at 15 kv: (1) To protect against the contaminated plant atmosphere due to the many chemical installations and nearness to the salt water of the Gulf; (2) for reliability against lightning and storm outages; and (3) for banking of feeders.

An overhead system with aerial cable is used in preference to an underground system for full utilization of the thermal capacity of the cable. The difference in capacity of aerial and underground systems is increased due to high earth temperature encountered on the Gulf Coast and because of plant load factors of nearly 100%. For example, a bank of six 2,000 Mcm, varnished cambric, single conductor, 15-kv cables, have a rating of 1,322 amp per cable in air. But underground, the same bank would be derated to 809 amp per cable; a loss of 38.8% capacity. Calculations are based on 45 C ambient temperature; 30 C earth ambient temperature; 100% load factor; 6 equally loaded cables in duct bank; and one cable per duct.

Also, an aerial system is used for greater reliability in preference to an underground system. Since large blocks of d-c power are used in the plants, with currents of 30,000 to 60,000 amp per block, the effects of possible stray currents on an underground system could be severe. In addition, an underground system would be exposed to any spilled chemicals and the hazard of accumulation of explosive gases in certain areas.

An aerial system is easier to repair in event of cable failure and is more flexible for change in plant operation. For example, this flexibility of construction has been used in the Velasco Plant in the past year by re-routing three feeders that were connected to facilities no longer in use and extending them to new plants.

Plastic Jacketed Cambric Cable

The cable used for power transmission has a copper conductor, varnished cambric insulation, natural or synthetic rubber jacket, and a 0.025 in. thick bronze interlocking armor overall. Copper shielding tape is now used on all new cable but was not used on the original single conductor cable. The cable jackets were originally of natural rubber, but when priority restrictions were set up some jackets were made of Buna N synthetic rubber. Now that better materials are available, the jackets are made of polyvinyl chloride plastic.

Three-conductor cable is used in 300 and 500-Mcm area stranded concentric conductors and in 100-Mcm area compact stranded, round conductors. Single conductor cable is used in 1,000-Mcm area concentric stranded conductor and in 2,000-Mcm area annual conductor. Of the above cables, the most used sizes are the 500-Mcm three conductor and the 2,000-Mcm single conductor.

The varnished cambric insulation thickness is 21/64 in. for the single conductor cable and 16/64 in. for the three conductor cable. The jacket is of a half-lapped tape with a built-up thickness of 4/64 in. for all cables except the single conductor 1,000-Mcm type which has a 6/64-in. extruded jacket. The armor on the 700-Mcm three conductor cable is of two 0.030-in. thick flat bronze tapes for reduction in the overall cable diameter.

Varnished cambric insulation is used because its flexibility, ease of splicing, and resistance to rough handling make it suitable for the large number of fairly short cable runs with numerous bends and splices which are encountered in the distribution system. Its ability to be used invertical risers permits changing the cable from one elevation to another.

The polyvinyl chloride jacket is used to protect the cable from moisture absorption. It is preferred to a lead sheath because a metallic sheath might be subject to fatigue failure near the points of suspension due to swinging of the cable in the wind.

The armor affords mechanical protection necessary for the jacket during installation of the cable. Also, it avoids the possibility of subsequent damage to the jacket by the cable supporting members. In addition, the armor provides a good path to ground connections for fault current. Bronze material is used for the armor, since it is non-magnetic and has high resistance to corrosion.

This type of cable is used indoors as well as outside thus permitting the same type cable to be used from generator to bus to load centers, and to load. It is not necessary to fireproof the cable by asbestos wrapping or duct work, since the effect of an electrical fault is localized with little burning of armor or insulation.

In general, the cable is supported by ½-in. bronze messenger and bronze cable rings. H type structures are

CONTINUED ON NEXT PAGE

RESULTS OF EIGHT YEARS' EXPERIENCE

RESULTS of eight years experience with an aerial cable system for 15-kv primary power distribution for the Dow Chemical Co. plants located on the Gulf Coast include:

1. No outages of the system due to lightning or storms.

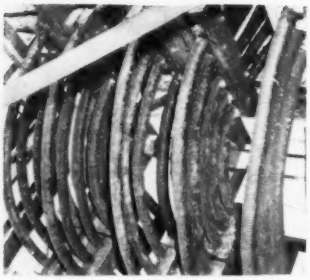
2. No failures due to contaminated plant atmosphere.

3. No accidents to personnel due to the power system.

4. Avoidance of an underground system has eliminated problems of electrolysis, stray currents, damage through the spilling or seepage of chemicals, and the possibilities of dangerous accumulation of explosive gases in cable vaults.

5. Cable failures have been at the rate of 0.10% failure per mile-year for the three-conductor cable. Difficulties with single conductor cable have been corrected, and no failures have occurred in two years operation with the new cable.

6. Aerial installation permits greatest utilization of the thermal capacity of the cable.



TO CHANGE DIRECTION, cable is clamped in treated wooden blocks

AERIAL CABLE (Continued)

used with 55 ft Class 1 treated Southern yellow pine poles. The structures are double armed using 4½ x 5½ in. Douglas fir cross-arms and are X braced. The poles are set on 4 ft diameter by 12 in. thick concrete pads, and are back filled with oyster shell to increase the load bearing ability of the soil. The poles of each structure are spaced 10 ft apart and provide for 6 cables on 14½ in. spacing between the poles. The vertical distance between cables is 30 in. with two or more tiers. Maximum spacing of the structures is 60 ft.

This type of construction is designed to withstand 125 mph wind velocities, with a factor of safety of 2. Adequacy of this hurricane type of design has been proved by the plants experiencing several storms with wind velocities over 100 mph without encountering a failure of the system.

Cable Performance

The performance of the three conductor cable has been quite satisfactory. In eight years of plant operation, with approximately 56.9 mile-years of cable service, there have been only six failures. This gives an average of 0.106 failure per mile year for the cable, as shown in Table I. Three splice failures occurred with this cable but have not been included in the table since the splices were not made by professional cable splicers and were made under adverse conditions.

The failures are well spread out over the period of operation. Since a fairly definite cause has been found for each failure it is expected that the future service of this cable will equal or exceed its present record. Of the six failures charged to the cable, the first two are thought to be the result of an overload condition that existed for a short time on one cable. The last four were attributed to defective workmanship in cable manufacture.

TABLE I—Performance of Shielded, Aerial Cable

Three-conductor, 300 and 500 Mcm, 16/64-in., Varnished Cambric Cable Used on 13.8-kv, 3-ph, 60-cycle, Grounded Neutral System

	Cable Installed			Cable Failures	
Year	Annual, feet	Cumulative feet	Total miles	Total No.	Per Mile-Year
1941	10,154	10,154	1.9	0	0.00
1942	27,265	37,419	7.1	0	0.00
1943	0	37,419	7.1	1	0.14
1944	3,434	40,853	7.7	0	0.00
1945	0	40,853	7.7	1	0.13
1946	0	40,853	7.7	0	0.00
1947	2,000	42,853	8.1	3	0.37
1948	7,760	50,613	9.6	1	0.10
Total	—	—	56.9 Mi-Yr	6	0.106

The performance of the single conductor cable has not been as good as that of the three conductor cable. In eight years of plant operation with approximately 46.8 mile years of cable service there have been a total of 22 failures. This is an average of 0.47 failure per mile year, as shown in Table II. Nine failures experienced in 1948 were not included in this table as they occurred on cable that was known to be defective and was in the process of being replaced.

The service of the cable was good for the first four years with only one failure in this period. But, the two oldest feeders began failing at an intolerable rate in 1945 and 1946. As a result, the cable manufacturer made an extensive study of the failures and reported in most cases that they were due to absorption of moisture into the insulation. The rubber hose jacket was found in a deteriorated condition because of corona and ozone, letting moisture enter the cable.

Single Conductor Improved

For corrective measures the specifications of the single conductor cable was changed to include: (1) A copper shielding tape between the insulation and jacket; (2) a jacket of polyvinyl chloride composition; and (3) for an increase of insulation thickness from 16/64 in. to 21/64 in. The increased insulation provides for the possibility of transient high voltage conditions occurring on feeders supplying rectifier station loads.

Cable manufactured according to the revised specifications has been in service for two years without a failure as shown in Table II. It is expected that the performance of this cable will equal that of the three conductor.

Most of the cable discussed was made in the war years of 1941 and 1942. Thus possibilities of defects in manufacture were increased because of stepped-up production; also, priorities prohibited the use of natural rubber for cable jackets.

Trend Towards Synthetic Compounds

In conclusion, varnished cambric cable with polyvinyl chloride jackets is now satisfactory for 15-kv aerial power distribution. But, probably the trend will be toward the use of synthetic compounds for the insulating medium for aerial systems at 15 kv as these compounds are further improved. With proper resistance to corona and ozone effects, this type insulation has the advantage of being simple in construction, quite flexible, and has greatly increased resistance to moisture absorption as compared to present type jacketed cables.

TABLE II—Performance of Annular, Shielded Cable

2,000 Mcm, Varnished Cambric Cable Used on 13.8 kv, 3-ph, Grounded Neutral System

	Annual Feet of Cable		Cable in Service, Cumulative		Cable Failures		
Year	Installed	Out of Serv.	Feet	Miles	No.	Mile-Year	Spec.
1941	13,505	0	13,505	2.5	0	0.00	A
1942	19,422	0	32,927	6.2	0	0.00	A
1943	4,500	0	37,427	7.1	0	0.00	A
1944	0	0	37,427	7.1	1	0.14	A
1945	0	0	37,427	7.1	9	1.26	A
1946	0	19,422*	18,005	3.4	4	1.18	A
1947	12,224**	6,681*	23,548	4.4	4	0.91	A
1948	2,598**		26,146	4.9	4	0.82	A
1947	6,681	0	6,681	1.3	0	0.00	B
1948	8,259	0	14,940	2.8	0	0.00	B
Total				46.8†	22	0.47	

Specification A—16/64-in. insulation, no shielding between insulation and jacket. Specification B—21/64-in. insulation; copper shielding tape.
* Cable deenergized because of plant shutdown. ** Cable placed back in service. † Mile-years.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

HOLLOW RUBBER CONES, that look like heavy pig iron, guide traffic around work and assure workmen of protection while on the job

Safety Cones Solve Traffic Problems

PETER TROHATAS
Associate Editor
Dayton Power & Light Co

HAVING WATCHED results, Dayton Power and Light crews now place their newly developed traffic cones with confidence. They know that with these sentinels on the job, traffic will be steered smoothly and effectively around them as they work in the busy streets of downtown Dayton.

These cones are made of pliable rubber and resemble a chunk of hefty pig iron. They are hollow and can be stacked atop one another like a stack of ice cream cones. Hence, they are easy to carry and can be strung along a traffic artery as shown in the photographs or distributed to form a wedge if the work underway should happen to be taking place in the middle of the street.

Results, thus far, have been more than gratifying. Workmen have felt confident of protection and traffic has been reluctant to drive too near the line of "pig iron" cones. Because of this keen respect for the cones, traffic has almost religiously adhered to the deviating flow suggested by the line-up of cones.

The beauty of it all, from the driver's point of view, is that if a driver should sidewipe a cone, no damage is done to the car. Nor does the cone itself change position. It merely flattens under the weight of the car, then pops up to its original shape and position when the vehicle has passed.

In comparison with the cones, Dayton Power and Light crews feel that the conventional wooden horses, lanterns, flags, danger signs, etc, have proved woefully ineffective. They have failed to give the men assurance on the job and they have failed to eliminate traffic jams due to the obstacle created by the work, all things that have been effectively accomplished by the hollow rubber cones.

Gel-Fired Boilers Put in Service Quickly

A FLAMMABLE GELATINE mixture is being used for the quick starting of stoker-fired boilers in several stations of Consolidated Edison Co of New York, Inc. The procedure supersedes the building of a bonfire of kerosene-soaked wood in the furnace.

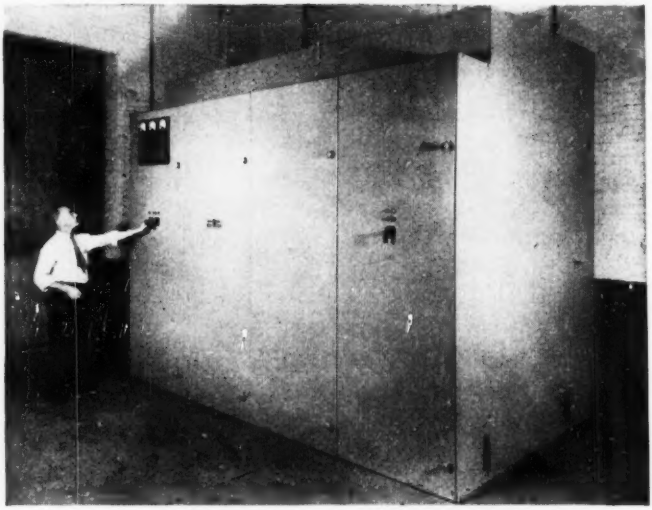
Various commercial ignition compounds were tried in place of the bonfire, without success. In November, 1945, Lee J. Levert, a division engineer in the Process Engineering Department, struck on the idea of employing a flammable gelatine mixture such as was used for incendiary purposes by the Armed Forces in World War II.

The Armed Forces had used a mixture of gasoline and Na-Palm, a chemical compound with aluminum

The Balmar Corporation
ENGINEERS MACHINISTS
BALTIMORE, MARYLAND

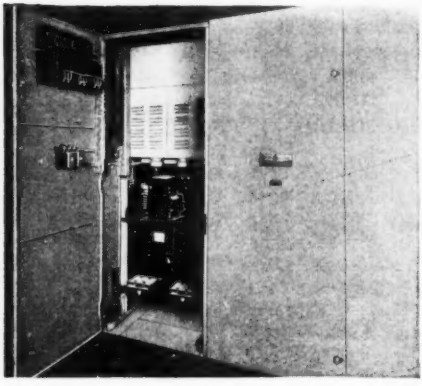
Manufacturers of Railroad Equipment

chooses



G. H. Slater, Plant Engineer of the Balmar Corp., inspects the General Electric 15-kv Type MI-6 metal-clad switchgear. Section lineup (left to right): Incoming line breaker, potential transformers, Power Co. metering, arc furnace feeder. Future plans call for two sections to be added to the right, one to the left, of the existing unit. Note neat appearance of metal-clad unit—it's space saving, too, and the metal-clad construction offers operating safety to personnel. And the three new sections will be added—when they are needed—with a minimum of fuss, bother, and expense.

Door of No. 1 compartment of metal-clad unit swung open showing magne-blast air circuit breaker (1200 amperes, 250,000 kva interrupting rating) in operating position. Magne-blast breakers are designed with adequate "IC" (Interrupting Capacity) for short circuit protection, are easily removed for inspection. Instruments and relays are co-ordinated for positive protection of high-voltage feeders.



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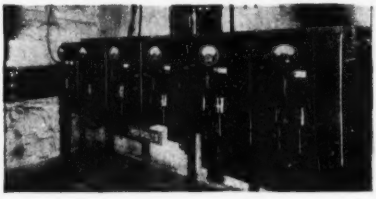

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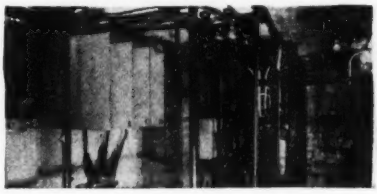
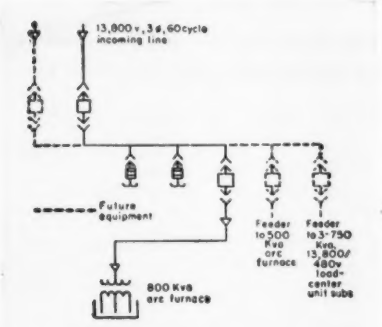


This old equipment was considered hazardous and deficient for present duties. Note dangerous, "spider-work" construction. Obsolete oil breakers of inadequate "IC" were seriously overloaded; in case of a bad short circuit could have exploded in a shower of flaming oil.

Metal-Clad Switchgear


13,800 v, 3 ø, 60 cycle incoming line
Future equipment
Feeder to 500 Kva arc furnace
Feeder to 3-750 Kva, 13,800/480v load-center unit subs
800 Kva arc furnace

Here's the one-line diagram showing the initial phase of changing over from 25 to 60 cycles at Balmar's Baltimore plant. General Electric 15-kv Type MI-6 metal-clad switchgear handles the incoming 13.8 kv through magne-blast air circuit breakers of 250,000 kva interrupting rating. Future plans call for another incoming line section, plus two more feeders.

The Balmar installation is a complete General Electric project—one source of responsibility, plus the very best in planning, engineering, manufacturing, and servicing facilities to give maximum savings and efficiency to the customer.

SEND FOR THESE HELPFUL BULLETINS

GEA-3083	Metal-clad Switchgear
GEA-4966	Low-voltage Metal-enclosed Switchgear
GEA-3592	Load-center Unit Substations
GEA-3758	Load-center Power Distribution
GEA-4507	Interlocked-armor Cable for Primary Circuits
GEA-4352	Flamenol Cable for Secondary Circuits

—here's why . . .

"As a part of our long-range plan of replacing old 25-cycle with new 60-cycle equipment we wanted completely metal-enclosed units to help eliminate danger to operating personnel. Our figures proved it was more economical to purchase a complete unit rather than a 'knocked down' substation. The cost of installing this metal-clad unit was negligible."

G. H. SLATER, PLANT ENGINEER, BALMAR CORP.

The Changeover at Balmar will continue over a period of years. This means only a small part of the total system capacity will be required during the early stages. A problem like this is easily solved with the General Electric load-center power distribution system that Balmar is using—it permits the installation of equipment as it is needed, and allows the over-all program to be accomplished in successive steps. This feature eliminates the necessity for tieing up large amounts of capital in equipment that would not be used to capacity for years to come.

The First Unit Installed was only large enough to handle its own load, plus a nominal margin for continuing the changeover program. As other units are added, this reserve becomes available for normal plant expansion and at no time will there be any large amount of unused capacity.

Modern Industrial Power distribution systems using G-E switchgear and load-center unit substations are applicable to any industrial plant or commercial building where you want full-voltage conditions for top performance of equipment, an extremely flexible setup to take care of expanding or changing loads, adequate short circuit protection, safety to personnel, and low installation and maintenance costs. A complete system, using G-E switchgear and load centers, costs you less than a "piece-meal," makeshift affair.

Investigate Today the many advantages of using General Electric switchgear and load-center unit substations in *your* plant for efficient, flexible power distribution. Contact your G-E sales representative for further information—and write for the helpful bulletins listed at the left. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

660-87

palmitate as its base. The Na-Palm, mixed with gasoline, produced a stringy, tough mixture which will cling to a surface even while burning.

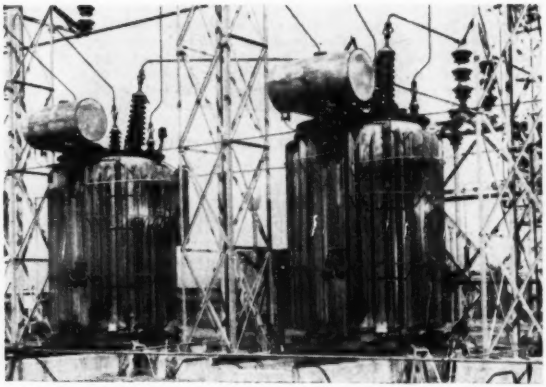
It was decided that substitution of kerosene or light fuel oil for the gasoline would make the flammable gel more suitable for generating station use. In January, 1946, experiments were started at the Waterside generating station. The tests were continued at the Sherman Creek generating station.

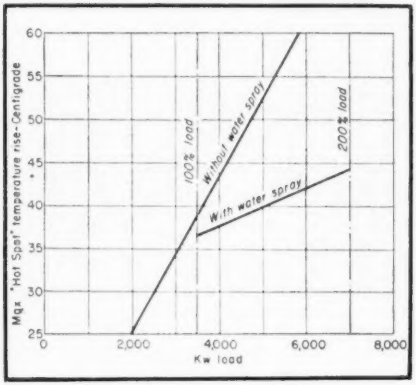
With this method the fuel bed is covered evenly with coal for about the first 3 ft of its length. A trench is made about 1 ft away from the throat of the boiler where coal is fed in. A strip of oil-proofed paper is placed in the trench so that the Na-Palm gel will not seep into the coal. Afterwards some 5 gal of the gel is placed in the trench in the form of a long, irregular ribbon.

At any time this ribbon may be ignited with a torch. Soon after, forced draft may be applied without fear of snuffing out the fire. Using the new method a 42,000 lb per hr boiler has been placed in service 26 min after the start. Fuel beds may be prepared with Na-Palm gel well in advance of need and left for indefinite periods of time. The procedure has become standard for all stoker-fired boilers on the system for both normal and emergency starts.

The Na-Palm gel does not present unusual storage difficulties. The precautions required for storage of light fuel oil are said to be ample in the case of the mixture.

Water Spray Saves Transformers





TEMPERATURE RISE materially reduced on 5,000-kva transformer bank by spraying it with cold water drawn from shallow well

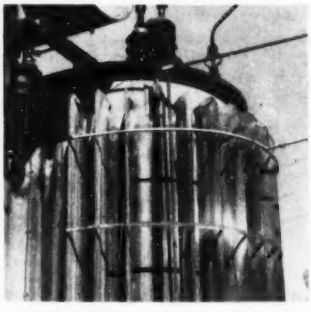
B. E. ELLSWORTH
Operating Engineer
Nebraska Public Power System
North Platte, Nebraska

SPRAYING 55 F water over cases and fins of substation transformers has saved several banks in Nebraska the past summer. Nebraska is blessed with an abundance of cold water, generally near ground level.

With 200% loads and over on large substations, some extreme means had to be used to carry away the heat due to transformer losses. New transformers, with two years delivery, were out of the question.

The policy has been to first install fans which will hold down temperatures to the boiling point of water up to approximately 150% transformer load. Above this loading, water spray is used.

The attached curve shows the effectiveness of this spray on a 5,000-kva bank composed of three transformers. The picture shows the temporary nature of the sprays and piping. It is essential to have the sprays circular in form so the water contacts all the available fins or radiators. Sprays are placed close to the transformers so wind will not blow the water to one side or up onto the bushings.

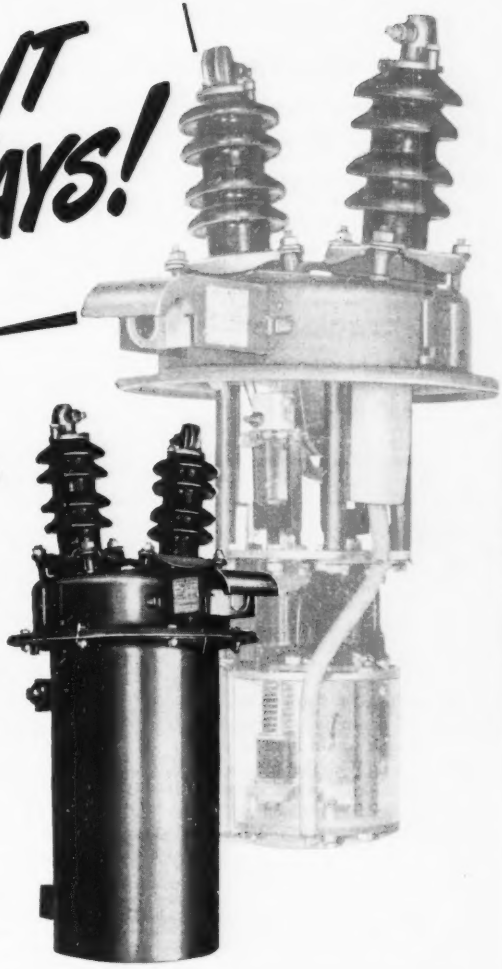


SPRAY PIPING fits snug to transformer so that most effective use is made of water and spray does not rise onto bushings

The installation shown uses a 40-ft well with water elevation 15-ft below the surface. A 3-hp motor was found sufficient for the needs. Drawdown in the well was negligible as the quantity of water used was small, probably around 50 gpm. By using V-belt drive and changing pulley sizes the maximum amount of water could be secured without overloading the motor. The cost of the well and piping was $500.

Run-off water was drained away after it reached the ground. Due to the porous nature of the soil no footing trouble is expected. In a clay soil the water probably would have to be caught in a wood or metal drain and kept away from the footings.

COMPARE IT THREE WAYS!



The FR-1 Relayed Automatic Recloser

1 FOR MINIMIZING OUTAGES

Fuses and conductors are protected by instantaneous first and second operations—very fast openings—regardless of ambient temperature, viscosity or condition of oil.

- False operations are prevented by precision timing—plus relay control of the interrupter—and, again irrespective of temperature or oil.
- Re-setting is 5- to 15-times faster than other types of reclosers—protecting against rapidly recurring temporary faults, even successive line flashovers by lightning strokes seconds apart.
- Inrush current cannot instantaneously retrip recloser.
- Fewer outages on every score.

2 FOR ECONOMIES IN MAINTAINING SERVICE

Fewer outages mean, of course, fewer service trips. Moreover the unavoidable outages can be located more quickly and service restored in less time.

- With the FR-1, many series fuses can be used to further sectionalize the system with permanent faults always confined to a minimum number of consumers. As many as 4 to 7 different ratings of fuses can be reliably co-ordinated with each rating of recloser because of the established minimum and maximum characteristics of the recloser and year-round accuracy.

3 FOR ENDURANCE IN SERVICE

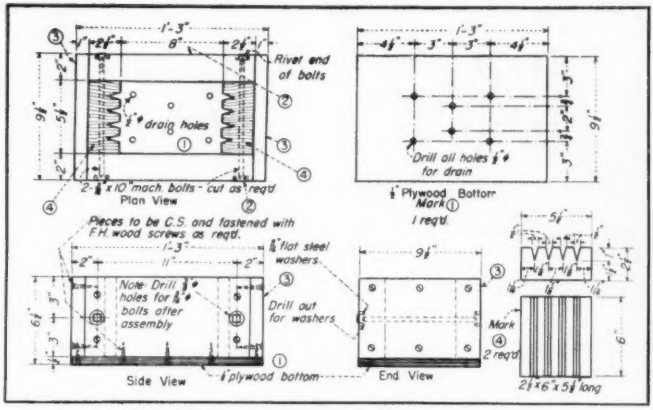
Oil Blast interruption of arc in ½ cycle means longer life—minimum wear of arc-resisting Elkonite contacts and minimum carbonization of oil.

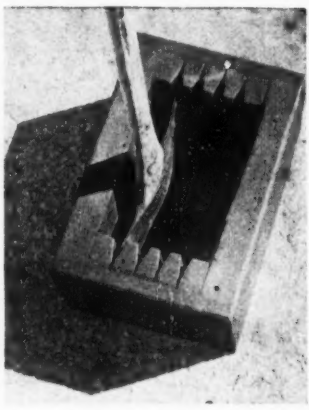
- Gears of heavy-duty escapement timer are case-hardened and plated. Timer operates in air above the oil, for lasting fidelity of timing and independence from temperature changes or viscosity of oil.
- Coils will withstand continuous current up to two times rating (up to minimum pickup current) without damage—unexpected overloads can't hurt the coils.
- Built-in Thyrite valve element by-passes lightning and surge voltages—protects turn insulation of coils.

Bulletin GEA-4934 describes in detail this unique recloser, gives data on co-ordination with fuse links and tells about its "locked-closed" alternate operating function (convertible in the field) which simplifies and extends co-ordination with fuses. For your copy address your G-E Apparatus Sales Office or write *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

Wooden Holder Designed for Double-Bit Axes


Rivet end of bolts
drain holes
2-¼ x 10" mach. bolts - cut as req'd
Plan View
Drill all holes ½" for drain
½" Plywood Bottom Mark ①
1 req'd.
Pieces to be C.S. and fastened with F.H. wood screws as req'd.
⅝" flat steel washers
Note: Drill ⅝" holes for ¼" bolts after assembly
Drill out for washers
Side View
½" plywood bottom
End View
Mark ④ 2 req'd
2½ x 6" x 5½" long



AX-HOLDER made of hardwood and plywood is designed for both safety and utility and accommodates four double-bit, 3½-lb axes

GLENN PLUMMER
Groundman
Minnesota Power & Light Co
Duluth, Minn.

THE NEED existed for an ax holder that would be sturdy and would stand the beating it would have to take in the line truck. With that idea in mind, a four-ax holder was designed and built, using a frame which was made from hardwood stock and plywood.

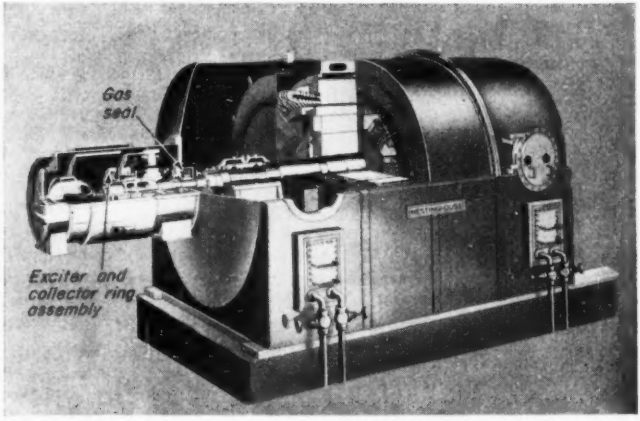
In making the holder, the major point to be considered is the length of the ax bit. Axes that have been in service are ground down. So the length of the holder would be a little greater where blades are new.

Other Design Points

Two other design points to consider are the weight of the ax and the thickness of the ax at the eye. The latter will determine notch spacing.

Accompanying illustration and outline show a completed holder 15 in. long, 9½ in. wide, 6½ in. high, built for four 3½-lb, double-bit axes. Hardwood material and fastener requirements are as follows: 1 x 6-in wood stock for ends; 2 x 6-in. stock for sides; 2½ x 6-in. stock for notched holder; ½-in. plywood for bottom; ⅝ x 10-in. machine bolts; ⅞-in. flat steel washers; material to be fastened with nails or flat-head screws.

Direct-Connected Exciters for Synchronous Condensers



SHUTDOWNS for maintenance are lessened when direct-connected exciter is used with a hydrogen-cooled synchronous condenser since brushes can be serviced while unit operates

A. M. GOODISON
Manager
Salient Pole Generator Engineering
Westinghouse Electric Corp
East Pittsburgh, Pa.

GENERALLY SYNCHRONOUS condensers provide no mechanical driving power for other apparatus and do not require an external shaft. The synchronous condenser, therefore, is the ideal machine to enclose for operation in hydrogen. It is, however, necessary to use a separate source of excitation such as a motor-driven exciter set. While it is rare that a failure should occur in the m-g set, it is potentially possible.

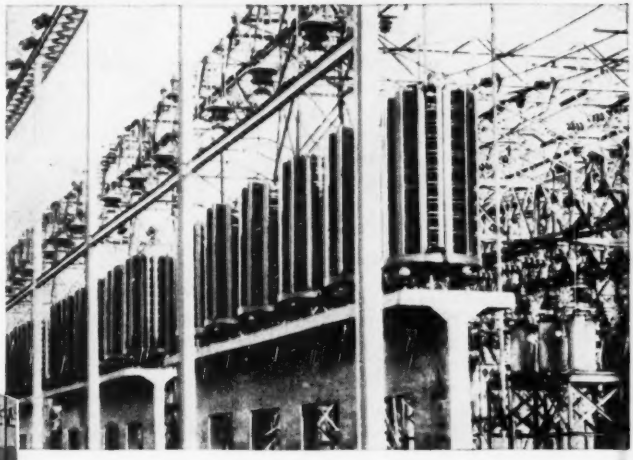
A totally enclosed unit having a shaft-driven exciter operating in the

(*Continued on page* 112)

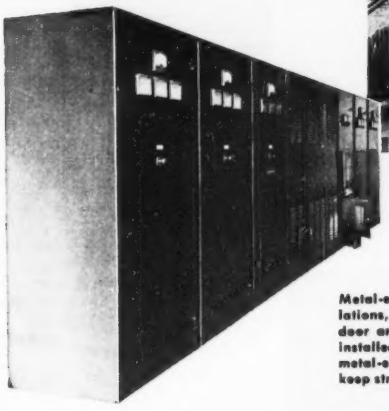
cast-in-concrete

Current-limiting Reactors

INDUSTRY'S FAVORITE FOR 35 YEARS



This 25-year-old installation has required practically no maintenance, has given no trouble. It consists of thirty-six 120-kva 3-phase 22,000-volt cast-in-concrete reactors, each giving a 3-per-cent reactive drop.



Metal-enclosed reactors can be matched to switchgear installations, and are becoming increasingly popular for both indoor and outdoor service. Here, three 3-phase reactors are installed between switchgear equipments. As with all G-E metal-enclosed reactors, the enclosure is specially designed to keep stray current — and electrical losses — to the minimum.

Nothing tops these cast-in-concrete reactors in mechanical or electrical strength, in resistance to weathering, or in long maintenance-free life. Conductors and concrete are a one-piece structure—with rock-like resistance to weathering and with the strength and rigidity to withstand short-circuit magnetic forces. Good clearances, elimination of through bolts, and crossovers made within the concrete supports give maximum protection against flashover. Special treatment during finishing processes renders them highly resistant to moisture.

Almost from the day they were introduced, 35 years ago, General Electric cast-in-concrete reactors have outsold all other current-limiting reactors by a substantial margin. And today—wherever you want a reactor to limit short-circuit current, to protect service on other parts of your system or reduce the current-interrupting duty of your breakers—they are still unbeatable.

Usual ratings range from 50 to 1500 amperes, and voltages up to 34,500. Details are given in publication GEA-976. *Apparatus Department, General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

401-56

Guying Details for Poles and Stubs

Adaptations from construction methods of
Pacific Power and Light Co, Portland, Ore.

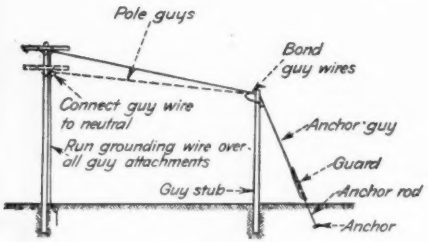


FIG 1—Pole and anchor guys (Note 1)

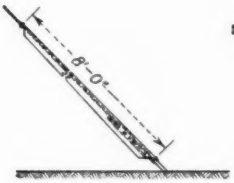


FIG 2—Anchor-guard

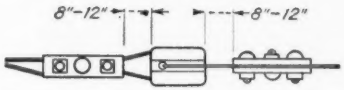


FIG 3—Guy strain insulator assembly

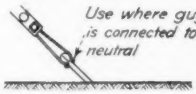


FIG 4—Guy rod bond clamp

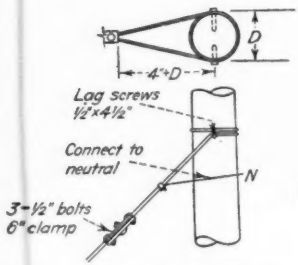


FIG 5—Pole or light anchor guy for guy wire 4,000 lb or less

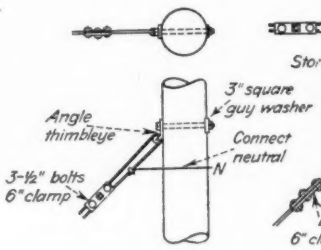
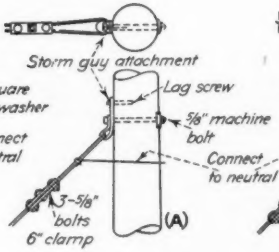


FIG 6—Medium anchor guy for guy wire 7,000 lb or less



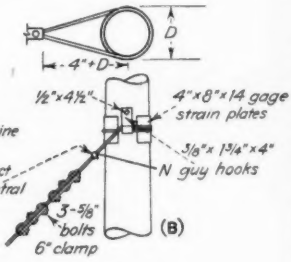


FIG 7—Heavy anchor guy for guy wire: (A) 11,000 lb or less; (B) 15,000 lb or less

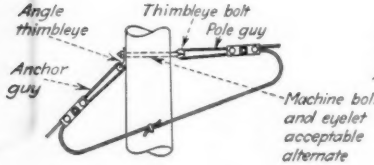


FIG 8—Pole and medium anchor guy for guy wire 7,000 lb or less

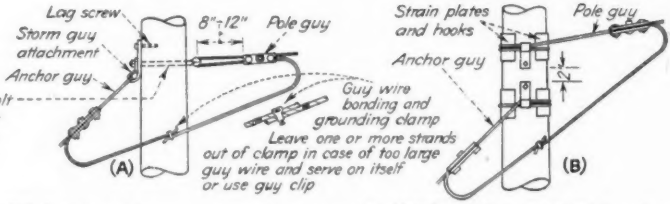

Lag screw
Storm guy attachment
Anchor guy
8"-12"
Pole guy
Guy wire bonding and grounding clamp
Leave one or more strands out of clamp in case of too large guy wire and serve on itself or use guy clip
(A)
Strain plates and hooks
Pole guy
Anchor guy
(B)

FIG 9—Pole and heavy anchor guy for guy wire: (A) 11,000 lb or less; (B) 15,000 lb or less

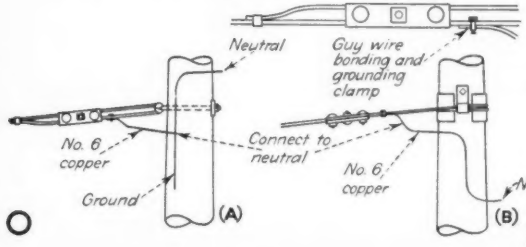


FIG 10—Guy wire grounding: (A) to ground wire; (B) to neutral conductor

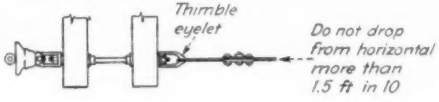


FIG 11—Crossarm guy

NOTES

1. Attach guy midway between arm and arm brace. Ground wires should clear arm braces as much as possible, never by less than 3 in.
2. Guy wire clips or bands may be used instead of serving for end of guy wire.
3. Bonding to be used where connection made to ground wire or grounded neutral only.

MUCH ELECTRICAL MANUFACTURING MAGIC BEGINS HERE

● One of the best known manufacturers of air circuit breakers in the country is the I-T-E Circuit Breaker Company, located at 19th and Hamilton Streets in Philadelphia. From its inception the company has displayed unusual receptiveness to new ideas, whether from within or without; hence it has done its share of pioneering, and perhaps more. Revere is proud to play a part in its progress, through close collaboration with I-T-E engineers, production men, and the purchasing department. The extensive use of Revere Extruded Shapes is but one result of our mutual attack upon I-T-E problems, which the company is good enough to say has saved a great deal of money, as well as made possible a better product . . . Perhaps similar results would be obtained if you gave us the opportunity to place our knowledge as well as our metals at your disposal. Why not inquire?

REVERE

COPPER AND BRASS INCORPORATED

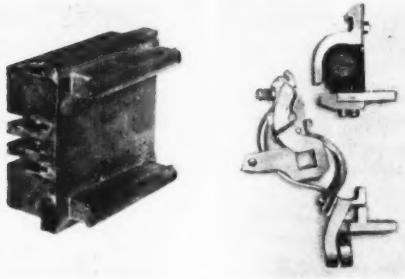
Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

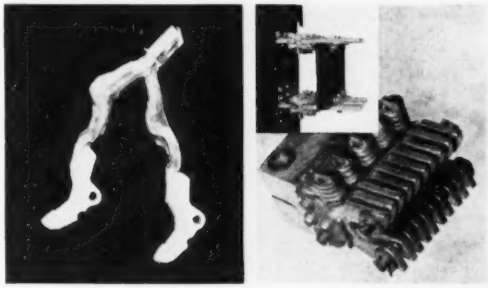
• • •

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

This is but a part of the I-T-E Stock of Revere Extruded Shapes in copper, brass, manganese bronze, and aluminum. I-T-E is a great advocate of extruded shapes, from long experience finding them markedly superior, in uniformity, strength, and economy due to the fact that a great deal of machining is avoided.



(*Left*) I-T-E Contact Block made from an extruded shape. This was formerly extruded in electrolytic copper; changing to Revere Free-Cutting Copper resulted in a saving of 30% in machining time. (*Right*) I-T-E "K" Breaker, Main Contact Assembly in open position. This is an especially interesting assembly, since it shows no less than eight extruded shapes in copper and bronze. Use of these shapes makes the assembly more compact, stronger, lighter, and considerably more economical to produce. The contacts are silver alloy, and the unit is silver plated. . . . In addition to supplying I-T-E with extruded shapes, and strip, Revere furnishes rolls, bar, rod, sheets, in a wide range of non-ferrous alloys, and seamless brass tube.



(*Left*) Main movable Contacts and Flexible Connectors in an I-T-E "K" Type Circuit Breaker. The two contacts are made from Revere Extruded Shapes. Revere and I-T-E collaborated closely on the specifications for the thin-gauge copper strip for the pigtails, working out the correct gauge and temper to avoid notch effects and cracking of the connection at the braze. (*Right*) Main Separable Contacts from an I-T-E Type "LG" Circuit Breaker. These are stamped from Revere Copper Strip with the temper specially controlled to eliminate a de-burring operation previously found necessary to obtain edge surface suitable for electrical contacts. (*Inset*) Back view of "K" type Breaker showing a similar type of contact.

Impedances for 1000 ft of Conductor At 50 C for Fault Calculations

R. W. BAKER and H. A. WIGGINS, Distribution Engineers, Georgia Power Co, Atlanta, Ga.

Tabulated 60-cycle impedance values are for three kinds of single conductors at urban and rural spacings

Impedances for Various Sizes of Three Kinds of Conductors

Wire Size	Phase Z_1 or Z_2		Neutral Z_0		Equivalent Z = $\frac{Z_1 + Z_2 + Z_0}{3}$ (A)		Correction for Neutral (B)	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
COPPER								
4/0 7 str.	.0574 + j.1191	.0574 + j.1311	.1195 + j.3451	.1165 + j.3418	.0781 + j.1944	.0771 + j.2013	.0026 − j.0834	.0016 − j.0765
3/0 7 str.	.0723 + j.1217	.0723 + j.1337	.1456 + j.3540	.1417 + j.3501	.0967 + j.1991	.0954 + j.2058	.0064 − j.0813	.0051 − j.0746
2/0 7 str.	.0911 + j.1244	.0911 + j.1364	.1771 + j.3652	.1722 + j.3605	.1198 + j.2047	.1181 + j.2111	.0106 − j.0785	.0090 − j.0720
1/0 7 str.	.1150 + j.1270	.1150 + j.1390	.2151 + j.3792	.2092 + j.3733	.1484 + j.2111	.1464 + j.2171	.0153 − j.0747	.0133 − j.0686
1 7 str.	.1449 + j.1297	.1449 + j.1417	.2594 + j.3969	.2524 + j.3896	.1831 + j.2188	.1807 + j.2242	.0201 − j.0697	.0178 − j.0641
2 7 str.	.1808 + j.1323	.1808 + j.1443	.3082 + j.4175	.3003 + j.4087	.2233 + j.2274	.2206 + j.2324	.0244 − j.0637	.0218 − j.0586
3 Solid	.2273 + j.1361	.2273 + j.1481	.3650 + j.4440	.3565 + j.4331	.2732 + j.2387	.2704 + j.2431	.0278 − j.0561	.0250 − j.0517
4 Solid	.2879 + j.1389	.2879 + j.1509	.4326 + j.4725	.4237 + j.4595	.3361 + j.2501	.3332 + j.2538	.0302 − j.0475	.0272 − j.0439
6 Solid	.4527 + j.1442	.4527 + j.1562	.5961 + j.5276	.5878 + j.5104	.5005 + j.2720	.4977 + j.2743	.0297 − j.0309	.0270 − j.0287
8 Solid	.7197 + j.1495	.7197 + j.1615	.8467 + j.5727	.8402 + j.5524	.7620 + j.2906	.7599 + j.2918	.0243 − j.0177	.0221 − j.0164
ACSR								
4/0 6/1	.1121 + j.1336	.1121 + j.1456	.2078 + j.3885	.2022 + j.3824	.1440 + j.2186	.1421 + j.2245	.0138 − j.0738	.0120 − j.0678
3/0 6/1	.1369 + j.1412	.1369 + j.1532	.2425 + j.4102	.2363 + j.4029	.1721 + j.2309	.1700 + j.2364	.0171 − j.0691	.0151 − j.0635
2/0 6/1	.1695 + j.1450	.1695 + j.1570	.2872 + j.4295	.2800 + j.4208	.2087 + j.2398	.2063 + j.2449	.0212 − j.0639	.0188 − j.0588
1/0 6/1	.2121 + j.1478	.2121 + j.1598	.3413 + j.4516	.3334 + j.4412	.2552 + j.2491	.2525 + j.2536	.0250 − j.0575	.0224 − j.0529
2 6/1	.3201 + j.1495	.3201 + j.1615	.4630 + j.4955	.4544 + j.4815	.3677 + j.2648	.3649 + j.2682	.0296 − j.0434	.0267 − j.0401
4 6/1	.4867 + j.1484	.4867 + j.1604	.6277 + j.5388	.6196 + j.5211	.5337 + j.2785	.5310 + j.2806	.0289 − j.0286	.0262 − j.0265
C.W. 40%								
8 Solid	1.8705 + j.1724	1.8705 + j.1844	1.9592 + j.6337	1.9562 + j.6106	1.9001 + j.3262	1.8991 + j.3265	.0115 − j.0050	.0105 − j.0047

NOTE: Column (A) is equivalent Z for phase-to-neutral fault with phase wire and neutral wire the same size. When neutral wire is not the same size, correct equivalent Z by subtracting the correction in column (B) from the value in column (A) for phase wire size and add correction for actual neutral wire size in column (B)

EXAMPLE

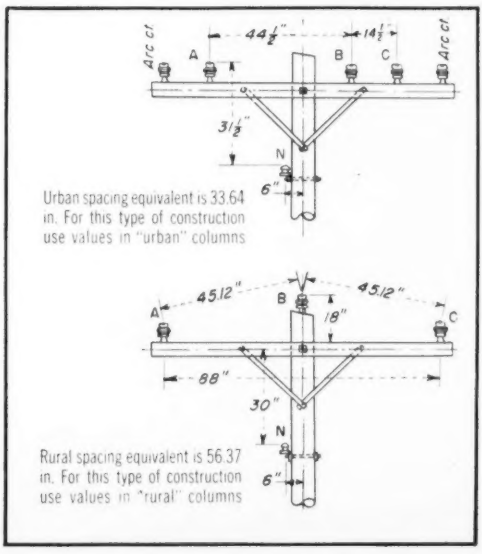
Circuit:

Urban; copper conductors
3 No. 1/0 str. for phase
1 No. 3 solid for neutral

Find: Equivalent Z for circuit

Calculation:

Equiv. Z for No. 1/0, (A)	=	.1484 + j.2111
Correction for No. 1/0, (B)	=	− (.0153 − j.0747)
		.1331 + j.2858
Correction for No. 3, (B)	=	+ (.0278 − j.0561)
Equivalent Z for circuit	=	.1609 + j.2297



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For EXTRA value—at NO extra cost—Insist on "GLAZON"

What "GLAZON" is:

"Glazon" is a tougher, more flexible, longer-lasting braid that combines the desirable properties of an inorganic substance derived from glass with those of special saturants to achieve a new high in safety and durability under the most adverse conditions. This new protective covering gives:

LONGER LIFE. Conductors and insulation are doubly protected by a stronger, tougher, more impervious and more durable covering than heretofore possible.

SMALLER DIAMETER. Braid, although stronger, is considerably thinner. Strands lie flatter, clasp insulation tighter, absorb less saturant—reducing diameter.

GREATER FLEXIBILITY. Less bulk and greater elasticity of the braid increase flexibility.

SMOOTHER SURFACE. Uniformity of fiber and tighter lays eliminate the uneven surface common to many braided coverings.

GREATER RESISTANCE to the destructive elements of man and nature: water, heat, oil, acid, corrosive fumes, fungus, rodents, sunlight, freezing, rotting.

IMPROVED FISHABILITY. "Glazon" covered wire can be snaked through longer conduits, around sharper bends, *easier, quicker,* than any other type.

EVEN SURFACE, free from bumps and ridges, slides easier.

SMALLER DIAMETER saves space, makes it twice as easy to snake in "that last one."

SMOOTH FINISH prevents slicking, reduces friction on long runs and around sharp bends.

TOUGH COVERING resists impact and abrasion.

GREATER FLEXIBILITY saves time in wiring every junction box, switch box, outlet box.

Costs No More—Yet Saves At Every Step of the Wiring Job

Available in sizes from No. 14 through No. 6 AWG with solid or stranded conductor.

Types R, RH, RW.

If It's "GLAZON" It's Made by TRIANGLE . . .
If It's Made by TRIANGLE It MUST Be Right!

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IT MUST BE RIGHT!

BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED TRIOPRENE TRENCH, POWER AND PARKWAY CABLES RIGID CONDUIT • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

Synchronous Condensers

(Continued from page 106)

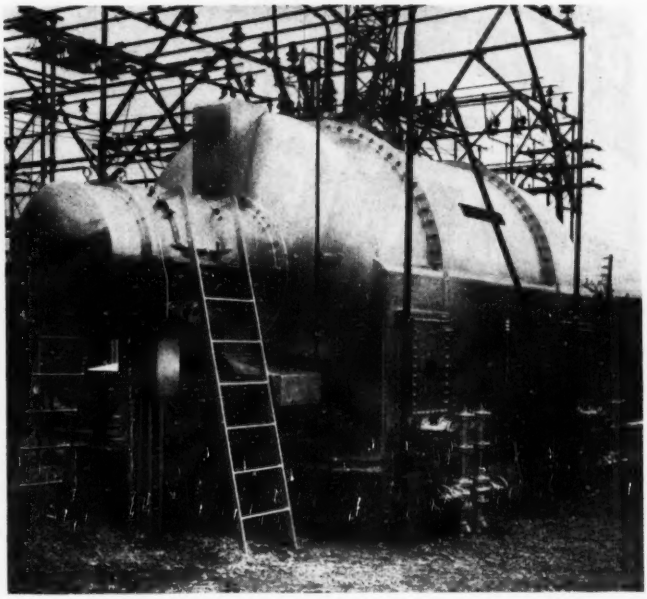
hydrogen-collector-ring compartment, was devised to overcome this minor objection. Operation of this unit has been generally satisfactory but due to the relatively large number of commutator brushes, it is necessary to service the exciter brushes and hence shut down the unit more frequently for this purpose than is necessary with only the collector rings operating in hydrogen.

Service Brushes While Unit Runs

A third unit retains the advantages of a shaft-driven excitation system and at the same time locates collector rings and exciter parts external to the main condenser enclosure. This permits servicing brushes while the unit is running. Potential explosion hazards due to improper gas mixture are definitely eliminated and machine outage time is reduced.

The new design requires that a shaft extension with suitable shaft seal be provided to drive the exciters. It is only logical to locate the collector rings also outside the hydrogen enclosure.

Two such units are now in service and except for minor difficulties expected with a new design are operating satisfactorily. One unit rated 15,000-kva, 900 rpm is operating on the system of the Mississippi Power & Light Co. The other rated 20,000-kva, is on the lines of the Carolina Power Co. Both ratings are based on hydrogen pressures of 0.5 psi.



INSTALLATION of a 20,000-kv hydrogen-cooled synchronous condenser with direct-connected exciter on lines of the Carolina Power & Light Co. Gas seal on extended condenser shaft let collector rings and exciter parts be located outside main condenser enclosure

Cluster Transformer Mounting Balances Pole Loading

GEORGE HINDMAN
Estimating Supervisor
Overhead Lines Department
Detroit Edison Co, Detroit

As CONCENTRATED loads in Detroit led to numerous installations of large transformer banks requiring two-pole platforms, or installations of transformers of the same bank a span apart, the author started studies that resulted in development of mounting three, comparatively large, single phase transformers on a single pole.

Outstanding advantage of the design was the mounting of units in a three-unit bank at 120 deg from each other giving a perfectly balanced load around the axis of the pole. When two transformers are installed in a bank they are mounted at 180 deg from each other with centers

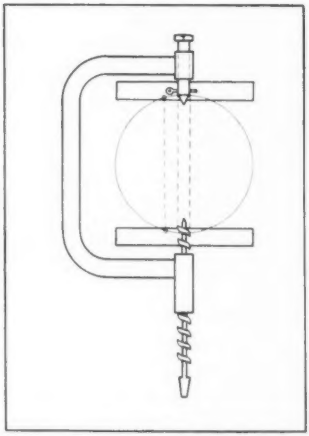


FIG 1—BIT GUIDE, used for drilling the four bolt holes, assures proper line-up between front and back supporting frame

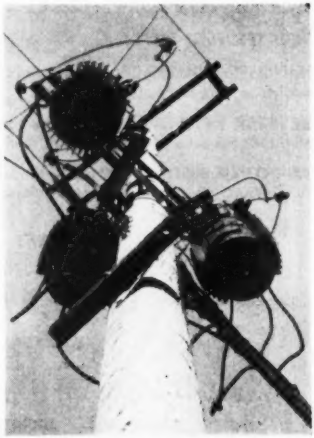


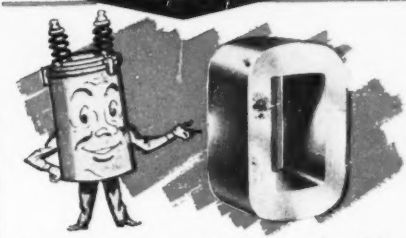
FIG 2—LOOKING UP at a cluster of three 50 kva transformers it can be seen that one quarter of the pole is left for climbing space

I'm built to take it ...and DELIVER!

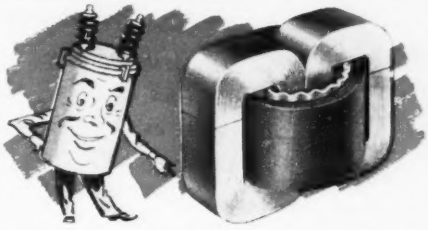
RAIN OR SHINE... it makes no difference! Load me or *overload* me, I'm built to take it . . . from the top of my bushings right down to the bottom of my cold-rolled, oriented silicon steel core. Moloney engineers considered everything that could possibly happen to a line transformer and went to work to design a transformer to do the job better. I'm the answer . . . literally a test-tube baby . . . *lighter, smaller, better* . . . with a "Surge-Tested" Design pedigree!

ME49-10

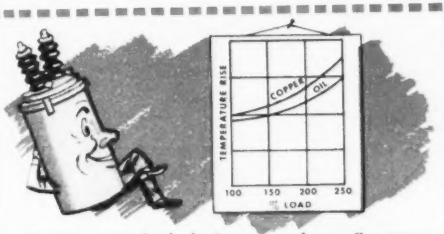
Here's WHY



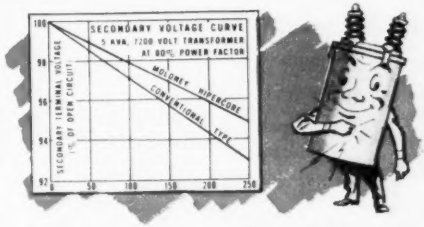
The cold-rolled, oriented silicon steel used in my core has 30% to 35% greater flux carrying capacity than non-oriented steel. In 3 Kva size I weigh but 125 lbs. including oil, and with CSP attachments only 140 lbs. Yet with less weight I have greater short-time overload capacity and provide better voltage regulation.



Because my cores are smaller, so is my coil. This reflects not only in my weight, but in my size. Ordinary transformers of the same Kva up to 30% larger find difficulty in performing tasks I consider routine. Besides, I don't need nearly as much space in the storeroom, on the line truck, or on the pole.



Short-time *overloads* don't get me down. Customer loads, being what they are, anyone with an ounce of temperature gradient knows that heavy peak overloads are inevitable. So I just keep calm and am thankful for my generously proportioned cooling ducts and maintain a lower hottest-spot-over-oil temperature.



My engineers say that some of my occupational hazards send many young transformers to an early grave. They tell me not to worry though, because my rugged constitution can take these hazards in stride and that I will live a lot longer on the job than many of my contemporaries . . . and perform better!

MOLONEY ELECTRIC COMPANY

Sales offices in all principal cities

FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONTARIO, CANADA

Illustrated: 5 Kva, 7200 to 120/240 volts Conventional Type HyperCore Transformer.

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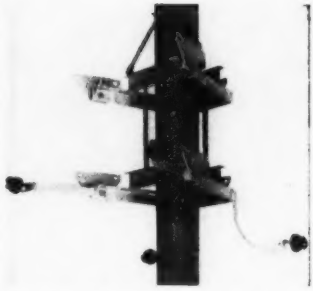


FIG 3—CLOSE-UP view of cluster bracket shows details of frame and mounting plates

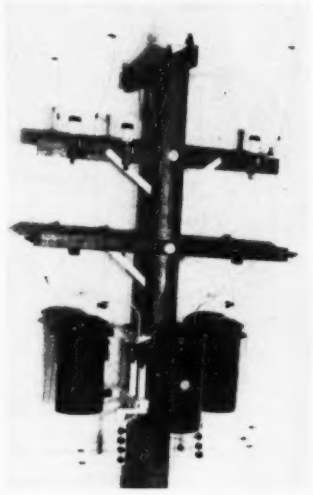


FIG 4—VIEW SHOWING how secondaries are made up. Climbing space is on the side of the pole away from the camera

of the transformers nearly in line with the vertical axis of the pole, thereby reducing eccentric loading to a minimum.

Other advantages of the design are:

1. Climbing clearance of about 34 in. on all sizes of transformers.

2. Simplicity of changing from open to closed delta and vice versa.

3. Ease of serving welding loads with three single phase transformers on a single phase primary leg.

4. Man hours required for building are only 70% of those for a platform type installation—

Three 75 kva in cluster requires only 40 man hours.

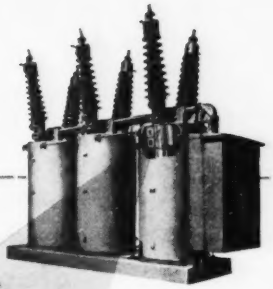
Three 75 kva on a platform requires 72 man hours.

5. Investment about 65% of platform cost.

6. Can be installed where mini-

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



WESTINGHOUSE BUSHING-TYPE LINEAR COUPLER TRANSFORMERS

SATURATION PROOF

for faster, more reliable bus differential relaying

Get fast, reliable relay protection "built in" your circuit breakers with Westinghouse linear coupler transformers. Installed in the same way as bushing-type current transformers, they provide straight-line characteristics, since there is no iron in the magnetic circuit. Accurate relay settings and performance may be calculated readily by means of a few simple equations.

Linear coupler transformers give you complete reliability at low cost . . . with no additional space requirements. They are applicable to all Westinghouse outdoor oil circuit breakers.

Bushing (Type BLC) and separately mounted (Type LC) linear coupler transformers may be used in conjunction with linear coupler relays for the protection of a single bus to reliably differentiate between internal and external faults.

For complete information on linear coupler transformers, call your nearby Westinghouse office. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60696

For complete information on Westinghouse power circuit breakers ask for B-3686 (up to 69 kv) or B-4012 (115 kv and above).

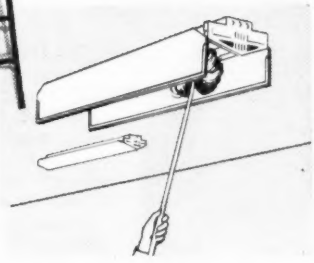
Westinghouse

POWER CIRCUIT BREAKERS FOR *ANY* SYSTEM

NO MORE ACROBATICS!

...to enjoy unequalled glass-diffused lighting:

GUTH
"floating-hinge"
ARISTOLITES*



are cleaned right from the floor

Experts agree glass diffusion provides the finest reflected-glare-proof illumination, but costly cleaning was always a drawback... until GUTH pioneered the "floating-hinge" **ARISTOLITE.** Its glass panels swing open for economical *ladderless* dusting that makes its high efficiency easy to maintain.

Next time you want high intensities, better distribution, less glare and no shadows, use the unique "floating-hinge" **ARISTOLITE** ....the luminaire that makes better quality lighting *practical!*

- For full details of this years-ahead fixture, send for Bulletin 830-H from

YOUR TEAMMATE IN *precision planned* LIGHTING

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

*Pat. No. 2,476,876

Leaders in Lighting since 1902

mum space is available and where it is difficult to find a place for setting required poles for a platform job.

Installation is simple and easy. As a rest for the supporting frame, 4 gains (2 on each side, ¾ in. deep) are cut in the pole. A bit guide, Fig 1, is used for drilling the four bolt holes through the pole to insure proper line-up between front and back supporting frame. It is necessary to install sling and blocks only once for a cluster as all transformers can be installed from the one position of blocks.

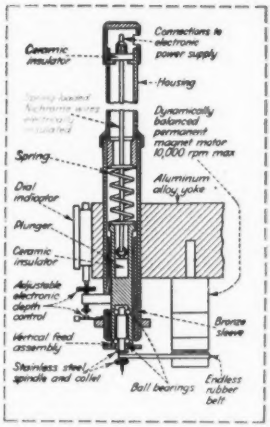
Designed to cover a range from two 25 kva to three 100 kva single phase transformers, the cluster frame lends itself to several different types of primary connections. An addition is made for the secondary bus when the cluster is installed on jointly used poles.

The Grouping of Secondary Loads

An Editorial in ELECTRICAL WORLD
January 15, 1898

MOST LIGHTING SYSTEMS operating high tension distribution mains in the districts of scattered population have made a practice of putting in small transformers, supplying as a rule one customer, or at the most two or three from each transformer. This habit naturally grew up in the days when 50 volts was the accepted secondary pressure; because of this low pressure proper distribution over any considerable area by means of secondary mains was impossible without a prohibitive amount of copper. Every transformer was necessarily of sufficient size to carry the largest load which might come upon it only very rarely. For example, in the case of a private residence supplied with some thirty outlets, a transformer capable of carrying twenty lamps would be necessary in order to serve in case of any social festivity requiring a general lighting of the building. This occasion might arise twice a year, the maximum load at any other time being one-half or

a Revolutionary method of drilling microscopic holes that depends on NICHROME*



High coefficient of linear expansion of Nichrome V permits maximum vertical movement of spindle with shortest possible length of wire.

High tensile strength of Nichrome V permits use of a spring large enough to furnish sufficient force to drive spindle down.

High heat-resistance of Nichrome V permits heating wire to 1700°F. without permanent elongation—affording substantial drill feed range.

High specific resistance of Nichrome V minimizes heating current required.

Until now, precision drilling of extremely small diameter holes (such as .0016″ dia.) has been manually controlled. Even with highly skilled operators, however, drill breakage has been frequent—resulting in waste of time and effort, and damage to work and equipment.

But now comes the revolutionary Microdrill. Relying on sensitive electronic circuits, instead of the human senses of feeling and sight, it operates infallibly and precisely by means of remote electric controls.

Heart of the drill press is a spring-loaded Nichrome V wire which, when heated electrically, expands, thereby lowering the drill spindle. Conversely, when heating current is decreased, it contracts and raises the spindle. Electronic control of the heating current effects extremely smooth vertical travel, the drill being raised or lowered at a precisely adjustable rate.

Holes as small as .0016″ in diameter are drilled with utmost ease—drill breakage reduced to a negligible minimum. Time is saved. Costs are cut.

Says the manufacturer, Teletronics Laboratory, Inc., Westbury, N.Y.: "The wire used in the Microdrill must have a high coefficient of linear expansion, high tensile strength, high specific resistance—and must be able to retain its physical and electrical properties at high temperatures. We know of no other wire as suitable for our purpose as Nichrome V."

If you, too, have a product-performance problem, why not consult with us. In addition to Nichrome and Nichrome V, we make over 80 alloys for the electronic and electrical industries. One or more of these may be what you are looking for.

50TH YEAR
SPECIAL PURPOSE ALLOYS SINCE 1899
D/H
TRADE MARK REG. U. S. PAT. OFF.
1899 - 1949

*Nichrome is manufactured only by

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco, Seattle

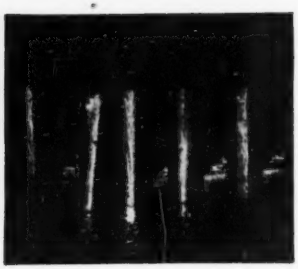
Manufactured and sold in Canada by
The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

*T.M. Reg. U. S. Pat. Off.

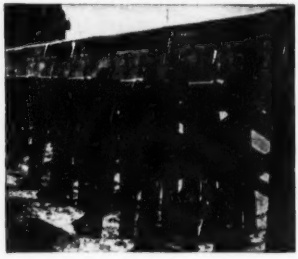
KOPPERS CREOSOTE
-to be sure!

DECKING 14 YEARS This car, with pressure-*creosoted* decking, was sidetracked for its first decking repairs after 14 uninterrupted years of service. Usual life of untreated car decking is about 5 years. Not only did pressure-*creosoting* cut maintenance costs; it prolonged the revenue-producing life of the car.

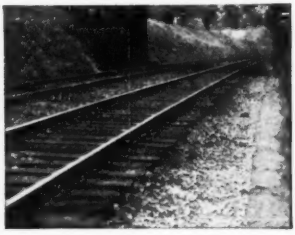
POLES 30 YEARS On the average, Pressure-*Creosoted* Poles have a life expectancy of more than 30 years. Pressure-*creosoting* offers *proved* performance and dependability.



PILES 30 YEARS Pressure-*Creosoted* Piles give unrivalled protection against decay and marine borers. Many *creosoted* marine piling installations are reported sound and serviceable after more than 30 years of use. Pressure-*creosoting* lowers maintenance costs.



BRIDGES 40 YEARS This is one of several pressure-*creosoted* timber bridges which is still in use after more than 40 years. The resistance of pressure-*creosoted* bridges to decay, year in and year out, assures uninterrupted service and low annual replacement costs.



TIES 25 YEARS Pressure-*creosoting* pays off to railroads. The long life of pressure-*creosoted* ties (25 years isn't unusual) has cut replacement costs $88,500,00 annually.

All Standard Specifications
For All Types of Wood Preservation
KOPPERS CREOSOTE
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less of the rated load of the transformer, and the average load in twenty-four-hour service the year around perhaps anywhere from 2 to 10 percent of the rated load. These figures may seem extreme, but there is no doubt that the majority of transformers in house service are loaded in very much this manner. A core loss of 3 or 4 percent of the rated load of the transformer would thus cause the average yearly efficiency to fall to a most alarming figure anywhere from 30 to 60 percent.

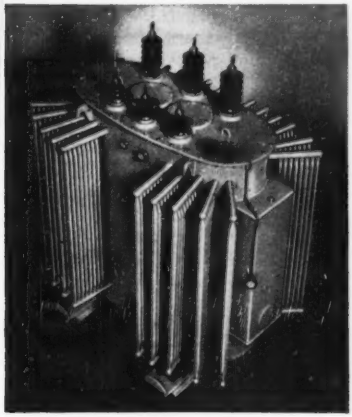
Neglecting for the moment the reduction in the core loss of one large transformer below that of a number of smaller transformers aggregating the same capacity, the grouping of a large number of secondary loads on one transformer may be made to cause a considerable saving for the following reason: All the loads will not simultaneously reach their times of specially heavy demand, and the one transformer supplying them need only be made sufficiently large to carry the average load at the peak of the daily curve. In this way very often, to cite a concrete example, a 100-light transformer may carry loads which, if divided, would require some eight or ten 20-light transformers. Added to this is the greatly reduced core loss per light of the larger transformer, and the combination is sufficient to render advisable the grouping of loads even to the extent of running a completely interconnected secondary system of wiring in most instances.

High Tension Secondaries

This grouping, especially in the extreme case of building secondary wiring systems, requires considerable copper, and renders advisable the use of high tension secondaries of some nature. The 50-volt secondary is now an anachronism. One hundred volts or more is the lowest pressure that should be used. Two hundred volt two-wire secondary systems are hardly advisable as yet, owing to the lower efficiency of the 200-volt lamp, as compared with that of 100 volts. Whether this condition will continue is problematical. Three-wire secondary systems, with 200 volts or more between the outside wires, are generally desirable, especially as the balancing of the system is so easily effected at any point with alternating currents by simple inductive balancing coils.

If you are interested in saving money, find out about

Pennsylvania STANDARD PARTS POWER TRANSFORMERS



The use of standard designs and parts shorten engineering and production time to give you lower prices and faster deliveries.

That's right! The economies we realize in manufacturing Standard Parts Power Transformers are passed on to you in the form of lower prices (prices are 4% to 6% less than conventional transformers) and faster deliveries. Pennsylvania Standard Parts Power Transformers permit limited variations, both in parts and in electrical characteristics, to meet a wider range of system requirements. It will pay you to look into this line of Power Transformers which provides the desirable features of custom built transformers at quantity production prices.

PREFERRED VOLTAGES AND BAND OF RATED VOLTAGES	
PREFERRED HIGH VOLTAGES	RANGE OF RATED HIGH VOLTAGES LINE TO LINE
2400	. .
4800	. . . . .
6900 7200	6600 to 9050
12000 13200 13800	11000 to 14750
22900	21500 to 24600
26400 34400	26400 to 36200
43800	42000 to 46000
67000	63000 to 69000

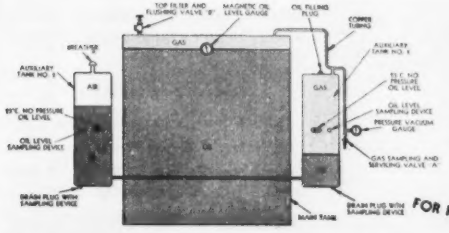
Auxiliary compartments, welded to each end of the transformer and connected to each other and to the main tank, form the following oil preservation systems:

Inert Gas-Oil Seal

Sealed Tank

Inert Gas Pressure System

All Standard Parts Power Transformer tanks, regardless of the type of oil preservation, are filled with the same quantity of oil, with the extra gas and oil spaces provided in the auxiliary tanks. Bushings with standard length shanks are used on all Standard Parts Transformers, and no special-size bushings need be stocked. This permits the user to change the method of oil preservation from Sealed Tank to Inert Gas-Oil Seal; and from Inert Gas Pressure System to Inert Gas-Oil Seal or Sealed Tank.



DIAGRAMMATIC DRAWING OF INERT GAS-OIL SEAL SYSTEM

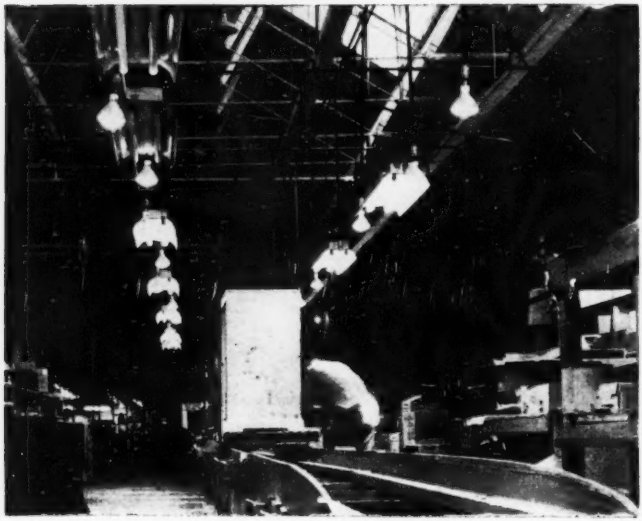
Pennsylvania TRANSFORMER COMPANY
PITTSBURGH 12, PENNSYLVANIA

FOR FURTHER INFORMATION WRITE FOR BOOKLET NO. 1492

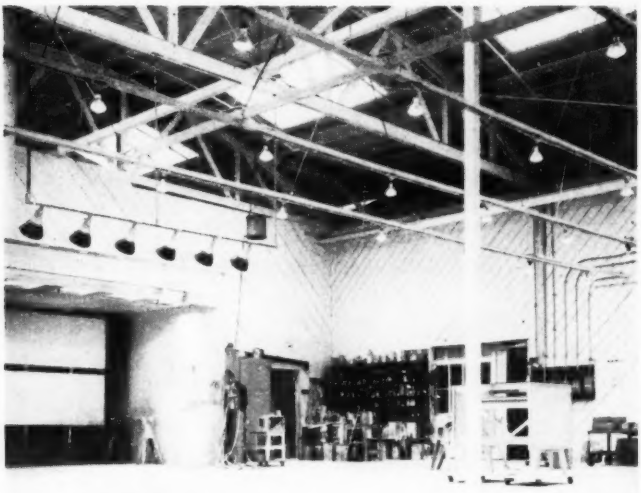
LOAD BUILDING

Factory Comfort Heating with Infrared Lamps

LOUIS E. ANDERSON
Industrial Heating Consultant
Los Angeles Department of Water and Power



INFRARED LAMPS provide comfort heating on this assembly line of Hoffman Radio in Los Angeles. Employees remain comfortable without need for heating entire building



HIGHER PRODUCTION rate with even better finishes was obtained as a by-product of blanketing this paint shop area of Grand Rapids Furniture Co, which is also in Los Angeles, with infrared. Entire plant uses over 100 kw to maintain comfortable working conditions

COMFORT HEATING with infrared lamps can be highly satisfactory in building areas with low density of occupancy or large volume. In such areas it is often uneconomical to raise the energy level of the entire area to a comfortable temperature. High thermal effectiveness of heat lamps provides an attractive alternative for heating such areas, since air does not absorb an appreciable amount of the energy radiated from filament lamp sources.

Acute Heating Problem

Hoffman Radio and Television Corp has installed such a system in its Los Angeles cabinet factory. The building, originally a streetcar barn, has a beam height of 24 ft and a ridge height of approximately 45 ft. In addition to the extreme height and large open space, air evacuation of a dual mill exhaust system and seven spray booths aggravate the heating problem.

Heat lamps have solved the problem. They transfer energy to workmen whose activities are localized without having to heat the surrounding air. More than 50 kw of 375-w, R-40, self-contained reflector lamps are mounted ten feet above the floor. Some assembly line functions use a single row of lamps mounted directly overhead. Other operations require lamps mounted in a rectangular pattern straddling the workmen. Spacing in either case is on approximately 4-ft centers.

Lamps Also Supply Light

In addition to warmth, the lamps supply light at the working surface. Swivel sockets are provided in some locations for directional control of lamps within the normal line of vision, since they may be a source of glare.

Famous since 1932...

Better than ever Today

Time-tested since 1932 under all service conditions, subsequent improvements provide additional security in this long-famous network cable.

ANW
Anaconda Net Work

Tough, easily handled, Type ANW-insulated, neoprene-jacketed cable incorporates six important advantages . . . important to you for underground duct installation.

1. Better heat and flame resistance—protected by the same neoprene jacket as Anaconda mining cables which must and do meet the severe flame test of the U.S. Bureau of Mines.

2. Higher resistance to duct acids and alkalies—years of experience with Type ANW insulation with only a braid covering showed it to be highly resistant to oils, acids and alkalies encountered in soil and sewage waters. NOW it has the additional protection of the neoprene jacket which itself has shown by test and experience, excellent resistance to these agents of destruction.

3. Higher operating temperature—now 75 C copper temperature, continuous duty.

4. Superior aging—Type ANW insulation has demonstrated year after year . . . and now even better . . . long-aging characteristics under severe oxygen bomb and air bomb tests.

5. Low moisture absorption—Type ANW insulation has always had low moisture absorption . . . far less than is detrimental to safe operation.

6. More easily handled—passes 180 degree cold-bend test at 0° C without damage to jacket. Cable is lighter, easier to pull. No lead to fuse, insulation and jacket do not support combustion.

ANACONDA

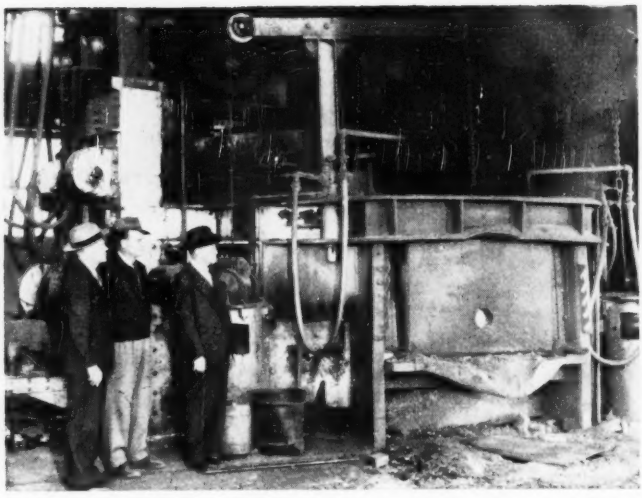
ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4, N. Y.

Use of the lamps has also eliminated an undesirable phenomenon of the wood used in the cabinets, called "blushing." It is caused by a combination of low temperature and high humidity. Raw cabinets are quickly brought up to the proper temperature range for application of stains and finishes, speeding production and producing better cabinet finishes.

Another successful application of infrared has been made by Grand Rapids Store Equipment Co of Los Angeles. The store management decided standard methods of air heating were impractical for their large drafty building. On the recommendation of the Los Angeles Department of Water and Power, six 375-w, R-40 lamps were mounted in porcelain sockets over one bench. The installation was so satisfactory that lamps were placed throughout the building, finally totalling over 100 kw. Three years experience has proved infrared to be a practical and economical method for heating this type of building.

Stainless Steel Mill Buys All Its Electrical Power



NEW 15-TON ELECTRIC FURNACE melting a heat of carbon-chrome bearing metal is supplied by a 5000-kva transformer. Left to right: C. V. DeWitt, Duquesne Light Co; R. H. Loutzenhizer, Crucible Steel Co of America; G. W. Ousler, Duquesne Light Co

PURCHASED ELECTRIC power is used entirely for the newly installed stainless steel plant facilities of Crucible Steel Co of America's Midland Works near Pittsburgh.

As part of an $18 million expansion program, these are said to be the first complete mill facilities in the country designed and built specifically for the production of stainless steel sheets and strip. New plant facilities include 25,000 hp in motors driving the new hot and cold mills and their auxiliaries. Also, a 5,000-kw and a 4,000-kw electric furnace have been added, making a total of six electric steel melting furnaces.

Electric power is supplied by the Duquesne Light Co. With these new mills in operation, Crucible has a load of more than 40,000 kw and consumes about 130 million kwhr per year. This is enough electric service for a city of about 200,000 population.

Higher Brackets Are Garbage Disposal Market

EDWARD R. TAYLOR
National Sales Manager
Hotpoint, Inc

KITCHEN MODERNIZATION offers the best opportunity for sale of garbage disposal units. This conclusion is taken from tabulation of first year returns in a continuing survey of buyers of Hotpoint products. The survey is based on insert questionnaires which buyers are asked to fill out after delivery of their purchases. Thus it does not cover appliances installed by builders of houses for sale. In specific respect of buyers of garbage disposers, the survey indicates that:

14% were building new homes.

47% were modernizing kitchens.

37% bought as separate purchases, not as included in new home building or in kitchen modernization.

52% had not, 46% had, previously seen a disposer in operation.

50% bought electric dishwashers at the same time; 15% electric ranges; 14% sinks; 11% cabinets.

46% did, 46% did not, arrange for installation of the disposer with the dealer who sold it.

73% bought from electrical appliance dealers, 12% from plumbing and heating contractors, 2% from department stores, 1% from utilities, 7% from other dealers.

20% owned homes in the price range, $6,000-$10,000; 25%, $10,000-$15,000; 54% over $15,000; 50% live in cities of 50,000 and above; 20%, 50,000-10,000; 16% 10,000-2,500; 1% on farms. 21% live in New York state.

Conclusions

From these ratios it is apparent that the garbage disposer stands on its own feet as a salable appliance as well as being a good sales companion with others; that its biggest market lies in large-city homes priced at $15,000 and above; that more dealers should be concerned about installation; that too few plumbers try to sell it.

Kentucky Utilities Company, Inc.
chooses
Steel Towers
for 138 K. V. Single Circuit Line

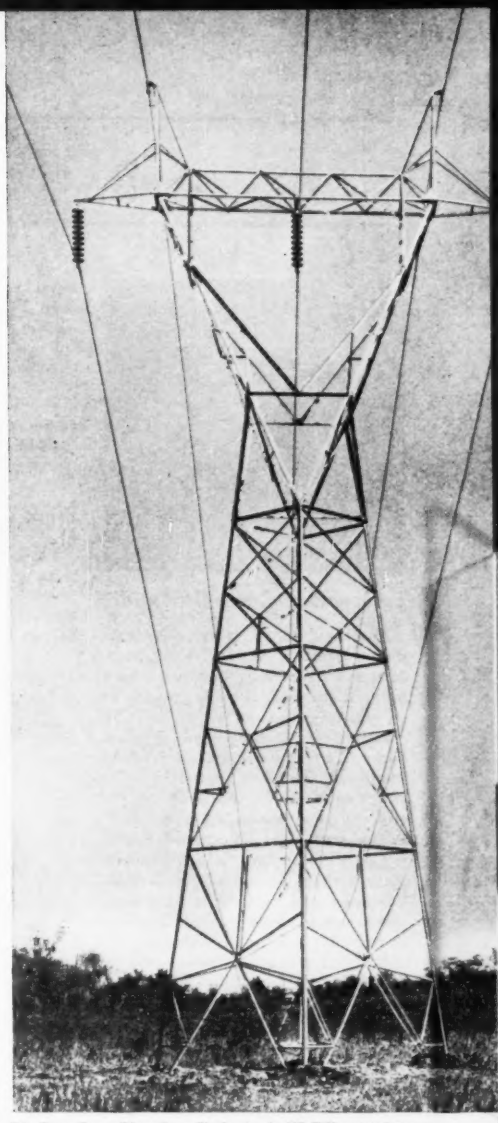
● When Kentucky Utilities Company, Inc., selected American Bridge light steel towers for its 138 K.V. single circuit line, it found that these towers made possible more severe design conditions because they had sufficient strength to carry longitudinal, transverse and vertical loads. Also, Kentucky Utilities found that foundation erection was quicker and cheaper because the circular steel grillages of the towers were designed to permit machine boring of anchors. Conductors and ground wires were carried in the most economical spans and the exact arrangement desired. And, like most things made of steel, these towers have the stamina to provide extra years of service.

To help you take advantage of the outstanding superiority of steel for structures of this type, American Bridge Company makes available its experience and facilities for designing, fabricating and erecting. Why not submit any questions you might have to our nearest Contracting Office.

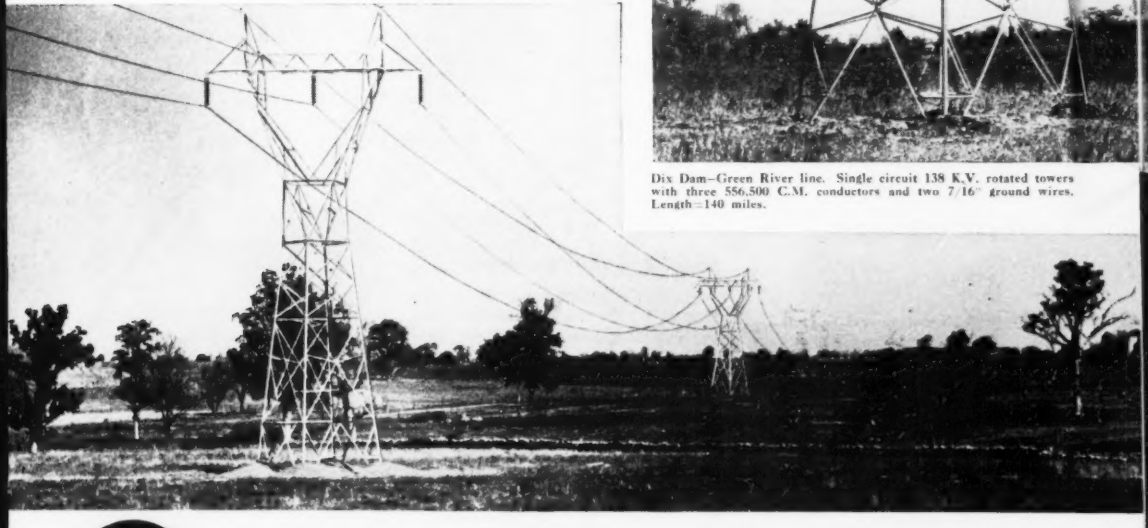
AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in: AMBRIDGE · BALTIMORE · BOSTON · CHICAGO · CINCINNATI · CLEVELAND · DENVER
DETROIT · DULUTH · ELMIRA · GARY · MINNEAPOLIS · NEW YORK · PHILADELPHIA
PITTSBURGH · PORTLAND, ORE. · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



Dix Dam—Green River line. Single circuit 138 K.V. rotated towers with three 556,500 C.M. conductors and two 7/16" ground wires. Length=140 miles.

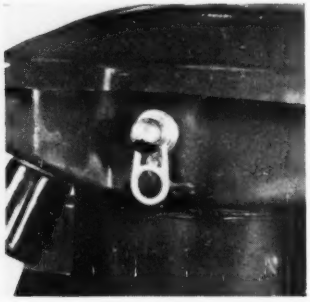


USS

AMERICAN BRIDGE

UNITED STATES STEEL

NEW EQUIPMENT



Emergency Control Handle

TEMPORARY EMERGENCY operation, during overload periods when transformer secondary breakers have dropped the load, is made possible by an emergency control handle for CSP transformers, according to Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa. This control permits higher overloads for longer periods but still provides short-circuit protection.

The small lever beneath the operating handle is pulled down to readjust the actuating element of the breaker. The red signal light continues to indicate overload when the handle is placed in operating position.

Initially, emergency control will be included on new standard CSP transformers 5 through 25-kva sizes inclusive, and on REA CSP transformers of 7.5 through 25 kva inclusive.

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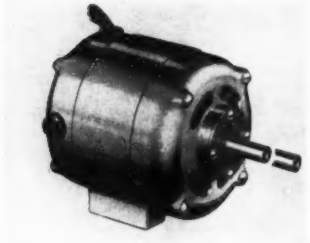

Universal Motor

RATED FROM 1/15 to ½ hp for continuous duty and ¾ hp for intermittent use (series wound), or ½ hp for intermittent duty (shunt wound), Model 700 motor is available from Electric Motor Corp, Division Howard Industries, Inc, Racine, Wis.

It can be wound for voltages from 6 to 230 v, dc or ac-dc, in a ventilated or totally enclosed housing. Bearings are of two types—grease-sealed ball or porous bronze sleeve. An internal fan, with top idling speed of 20,000 rpm. cools the motor.

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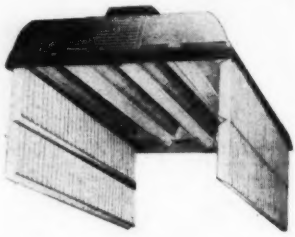
Fluorescent Luminaires

FEATURING an individual parabolic reflector for each lamp, the Paralier Series of fluorescent fixtures has been announced by Moe-Bridges Corp, Sheboygan, Wis. Illustrated is the 11-Line



Forty-Eight fixture which takes four 40-w lamps.

The manufacturer advises that individual parabolic reflectors provide maximum downlight for the useful seeing zone with enough light upspill to avoid contrast. All fixtures are available in white baked enamel finish or Alzac aluminum and can be surface or pendant mounted, individually or in continuous rows.

•

Mobile Radiotelephone

MOBILE radiotelephone units for the 152-162 Mc band have been announced by Karr Engineering Co, Palo Alto, Calif. The manufacturer reports that the instant-heating transmitter consumes no power during standby periods, and that the low-drain receiver uses but 4 amp.

Economy and small size of this FM-47X receiver and FM-177X 15-w, or FM-179X 50-w, transmitter are said to broaden use of mobile radiotelephone equipment.

A-C Load Visualizer

COMBINING five instruments into one, a new and improved a-c load visualizer has been announced by General Electric Co's Meter and Instrument Divisions, Schenectady 5, N. Y. A standard 0–2.5/5/25/50-amp ammeter and 0–150/300/600-v voltmeter, Type AF-2 visualizer also can be used with a split core or a conventional instrument transformer to extend the range for determining watts, vars, volt-amperes and power factor. Frequency range is 50–60 cycles.

The instrument is magnetically damped, fully shielded, and has external zero set. All readings are made on one dial. Accuracy is reported to be within 2% for voltage and current and within 5% for current components.

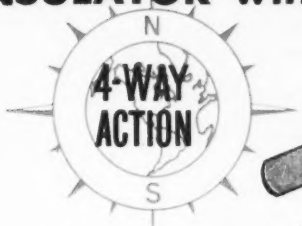
•

Bi-Metal Thermometers

FEATURING a heat-resistant dial which can be read from a considerable distance, stainless steel, bi-metal thermometers are available from W. C. Dillon & Co, Inc, 5410 W. Harrison St, Chicago 44, Ill. These instruments are made in 5, 3, 2¼ and 1-in. dial sizes with stem lengths from 4 to 42 in.

Once Again HUBBARD *Leads the Field!*

A NEW WOOD STRAIN INSULATOR with



Direction of pull indicated by large arrows

Small arrows indicate the resultant forces on wood member when strain is applied. Pressure is inward on all four sides of the wood. (Patent Pending)

As tension is applied to the new Hubbard Wood Strain Insulator, the interlocking plates start moving forward. As they move slightly, the inclined planes under the heads and nuts of the assembly bolts cause a simultaneous motion inward, 90 degrees to the line of pull, and on all four sides of the wood member. In older designs the "squeeze" has been applied transversely in two opposing directions only, which results, under excessive pull, in a crushing and "flowing" of the wood fibres until a limit is reached where the bolts shear out of the wood.

With the Hubbard 4-way design, the "squeeze" is from all four sides. There is no relief area into which the wood can "flow." Consequently, the fittings hold to the full strength of the wood member. Tremendous holding power has been achieved by this development. Pulled to destruction, no fractures have occurred under a fitting but always in the clear part of the wood. For the first time, a wood strain insulator is available with perfectly designed fittings and at a low cost.

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND
CALIFORNIA

Nine temperature ranges include 0–200 F, 50–500 F, 200–1,000 F and −10–110 C and 0–300 C.

Units may be placed directly into hot liquids or gases without preheating. Mounting nuts are provided for screwing into vessels, ducts and piping and other housings. For use on plane surfaces such as bus bars, the thermometers can be furnished with a flat tip of aluminum or other metals. If desired, permanent magnets can be supplied mounted on either side of the flat tip.

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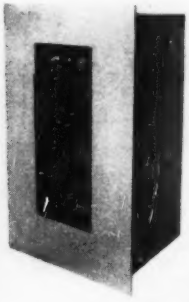


Annunciators

FOR SUPERVISION of controls utilizing electrical contacts in power and industrial plants, a line of Super-Vize lamp annunciators is announced by The H. R. Kirkland Co, Morristown, N. J. These units can perform any service that can be effected with a tpdt contact arrangement on the relay contacts and with a dpdt toggle switch.

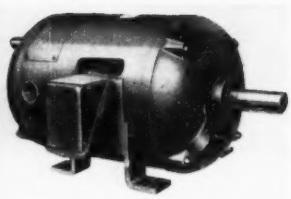
Audible signal is cutoff by toggle switch. Two bulbs behind plastic face plate produce a brilliant and easy to read message and remain lit until trouble is corrected. Annunciators require a minimum of space; for example, a 30-section unit (three rows of ten face plates) fits into a 16x19-in. cabinet, including a 2-in. trim. Flush type units have removable rear panel for maintenance; surface type units are mounted on swinging door.

•

Power Supply

FOR APPLICATION in dust precipitation, electrostatic painting and insulation breakdown tests, a completely enclosed, variable r-f power supply is made by Spellman Television Co, Inc, 130 W. 24th St, New York 11, N. Y.

Voltage is varied from 15 to 30 kv through a front panel control. The company advises that up to 500 μamp may be drawn with good regulation. This power source measures 14⅛ x 11⅛ x 12⅛ in.



Wound Rotor Motors

FOR APPLICATIONS requiring smooth acceleration, high starting torque with low starting current, frequent start, stop or reverse, or variable speed, Form BW protected-type wound rotor motors are built in NEMA frames 224-205 in ratings up to 100 hp, and in larger frames up to 2,000 hp, by The Crocker-Wheeler Electric Mfg Co, Division of Joshua Hendy Corp, Ampere, N. J.

Frames and end shields are dripproof. These motors are also available splashproof, and totally enclosed nonventilated. Also available are NEMA floor, sidewall and ceiling mounting assemblies, and NEMA C face and D flange mountings for horizontal or vertical operation, with or without feet.

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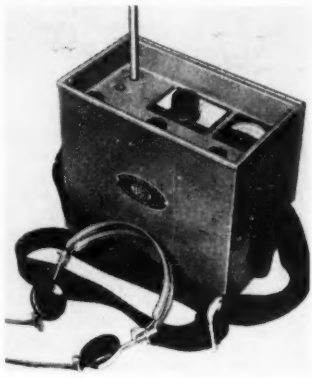

Radio Noise Locater

LOCATION OF NOISE heard in broadcast and short-wave receivers, as well as television interference, is made possible by Model 248 portable radio interference locater, manufactured by Tobe Deutschmann Corp, Instrument Div, Norwood, Mass.

The instrument gives four-band coverage from 200 kc to 18 Mc, plus spot checks at 50 and 150 Mc. Interference is localized by a-f pickup and is indicated on a 0-100 db meter. Battery condition is also indicated on this meter.

Weight of the locater, including tubes and batteries, is 17 lb. Rod antenna is 39 in. long extended and 10½ in. long when collapsed for storage in case. For more information, request Bulletin T.

•

Railroad Car Shaker

FOR UNLOADING bulk granular materials from open top, hopper-bottom gondola cars to track hoppers, a car shaker is manufactured by Link-Belt Co, 300 W. Pershing Rd, Chicago 9, Ill.

This car shaker is said to offer these advantages: Relatively low initial cost; especially effective on damp materials in cold weather; less harmful to cars than their rolling over normal road beds; and relatively quiet operation. It weighs 9,500 lb, complete with 20-hp motor wound for three-phase, 60-c, 220/440-v operation. Further information is available in Link-Belt Book No. 2345.

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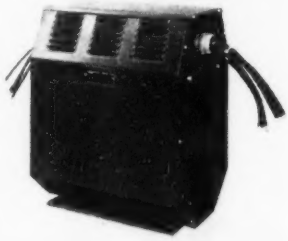


Dry-Type Transformers

HAVING TWO rated-kva 5% taps below rated primary voltage, dry-type transformers have been announced by General Electric Co's Specialty Transformer and Ballast Divisions, Schenectady 5, N. Y. These tapped units provide users with 120/240-v output from undervoltage lines, it is reported.

With ratings from 1 to 50 kva, Type M and D transformers are designed for both 480 and 600-v supply lines with series-multiple secondaries.

•

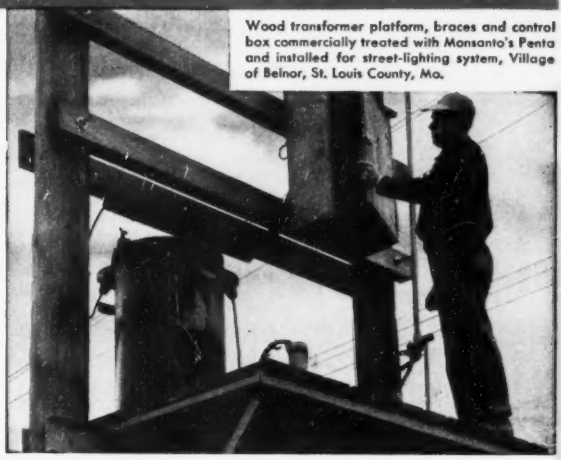
Mobile Microphone

FEATURING a stainless steel hanging button on the face which permits picking up and replacing mike without turning it over in the hand, a shock and vibration proof mobile microphone is produced by Roanwell Corp, 662 Pacific St, Brooklyn, N. Y. Two press-to-talk buttons permit operation with either thumb or forefinger.

This unit is designed to match 50–200-

this can't happen here

These rotten, unsafe wooden members were replaced with Monsanto Penta-treated material.



Wood transformer platform, braces and control box commercially treated with Monsanto's Penta and installed for street-lighting system, Village of Belnor, St. Louis County, Mo.

PENTA

(Santophen 20)

CHLOROPHENOL preservative

Treatment with Monsanto's Penta will add years to the service life of your poles, crossarms and structural wood. It provides long-lasting protection against decay, termites and other wood-destroying insects, yet leaves wood CLEAN and workable... Penta-treated material is dark or light-colored, depending upon the oil solvent used. In either case, it is still CLEAN and non-staining.

Monsanto's Penta penetrates thoroughly. Protection stays in the wood, resists leaching by moisture, remains effective under high humidity. Furthermore, Penta is a definite chemical entity — its characteristics are always constant, always laboratory-controlled.

Men who plan or maintain transmission lines and wood construction quickly recognize the advantages of Monsanto's Penta — described in the booklet, "PENTA ... The Best Protection for Poles and Crossarms." Send for your free copy today. MONSANTO CHEMICAL COMPANY, Desk G, Organic Chemicals Division, 1758 South Second St., St. Louis 4, Missouri.

MONSANTO
CHEMICALS — PLASTICS

Santophen Reg. U. S. Pat. Off.

MONSANTO CHEMICAL COMPANY
Desk G, Organic Chemicals Division
1758 South Second Street, St. Louis 4, Missouri

Please send me a copy of "PENTA ... The Best Protection for Poles and Crossarms."

Name _____ Title _____

Company _____

Address _____

City _____ State _____

SERVING INDUSTRY ... WHICH SERVES MANKIND

put the screws on COSES

with FRANKEL clip tap

cut original costs! Frankel Clip Taps cost you less...⅓ to ½ less than "bug" type connectors in equivalent sizes!

reduce installation costs! Compact Frankel Clip Taps are speedier to install . . . only one small ordinary wrench is needed to tighten the standard hex head bolts instead of the oversize wrenches required to tighten the large nuts of split-bolt connectors. Faster, easier taping because of rounded edges and recessed bolts.

get these extra advantages! Frankel Clip Taps are the perfect connector for heavy duty service. Completely encircles and firmly forces conductors into high pressure contact. Lock washers keep it tight, always! No removable parts . . . no hardware to fall off in installation. Five sizes take all conductors from 2/0 to 1000 Mcm main with any size branch. Made of electrical bronze with non-corrosive Everdur bolts for extra strength.

Approved by Underwriters' Laboratories in all five sizes

Write today for descriptive sheet CT and price list.

SOLD THROUGH LEADING WHOLESALERS ONLY

Frankel Solderless Connectors

FRANKEL CONNECTOR CO.

27 VESTRY ST. • NEW YORK 13, N. Y.

42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS

ohms circuits at 5–100 ma. Model 9900 has output level of 32 db below 1 v for 10 bars; Model 9901 has output of 25 db below 1 v for 10 bars. Both models are equipped with a length of helical cord.

•

Arc Welder

For use by small shops, garages and maintenance crews, a portable, 200-amp a-c arc welder is available from Air Reduction Sales Co, 60 E. 42nd St, New York 17, N. Y.

Known as the Wilson 200 amp Max MCT, this machine has these features: Stepless control throughout each of two ranges; capacitors for ease of initiating arc and for power factor correction; and windings insulated with heat-resistant spun-glass fibre. It is self-contained in circular steel tank and is equipped with a 10-ft, three-conductor rubber-covered primary cable with lugs attached.

•

Slimline Lighting Unit

For retail stores or large offices, a louvered fluorescent lighting element has been introduced by Smithcraft Lighting Div, Chelsea 50, Mass. Called the Director, this unit is said to provide a large area-of-light source without being obtrusive.

Available for two, three, four or six T-12 or T-8 instant-start Slimlines, and in matching units for two, three, four and six 40-w T-12 lamps, the Director can be surface or pendant mounted. Louver releases partially for relamping and can be "shelf suspended" for electrical servicing.

•

Insulating Laminate

For use in rotating machinery, transformers and switching gear, a Fiberglas-reinforced plastic insulating laminate called Glastic is available from Laminated Plastics, Inc, 14838 Euclid Ave, Cleveland 12, Ohio. The announcement states that this material is capable of withstanding high temperatures and is not affected by outdoor exposure, hydrocarbons and moderate acids generally.

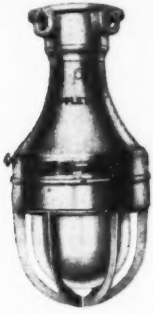
Tentative properties for grade WU include: Tensile strength, 76,000 psi;

MORE FOR EVERY LIGHTING DOLLAR!

Industrialite High Mounting Fixture
For use in railroad yards and round houses, steel mills, foundries—hundreds of industrial installations.

Seprable Standard Dome Reflector
Hood is easily detached for cleaning or servicing without disconnecting wires. Weatherproof.

Diffuso Floodlight
For even illumination of service stations, athletic fields, tennis courts, parking spaces, etc. Available for Pole, Bracket or Cross arm mounting.



Type EVX Explosion-Proof Fixture
Ruggedly built of tough, malleable iron, this Fixture provides safe, superior illumination for hazardous locations.

APPLETON LIGHTING EQUIPMENT

Appleton Lighting Equipment is scientifically designed to provide maximum lighting efficiency at minimum installation, service and operating expense.

The manufacture of Appleton Fixtures is quality controlled from raw materials to finished product. Metal parts of reflector are made of pure ingot iron—tough, long-wearing metal that is ruggedly corrosion-resistant. Vitreous-fired porcelain enamel finish provides maximum reflecting efficiency.

Including hundreds of types and sizes, the Appleton Line contains a fixture to fit virtually every lighting requirement, whether indoors or out. Sectionalized construction of all types assures quick, easy servicing. Get the most from your lighting dollar. Specify Appleton, STANDARD FOR BETTER LIGHTING.

Write for complete Catalog information.

Type EFU Explosion-Proof Fixture
Up-to-the-minute version of the first Fluorescent Lighting Fixture ever to be developed. Can be hung horizontally or at 45-degree angle.

SOLD THROUGH ELECTRICAL WHOLESALERS

APPLETON ELECTRIC COMPANY

1701 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church Street • DETROIT, 3049 E. Grand Blvd. CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue ATLANTA 724 Boulevard, N. E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. BALTIMORE, 100 East Pleasant Street • BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street.

Resident Representatives: Cincinnati, Dallas, Houston, Indianapolis, Kansas City, Milwaukee, Seattle • *Export Representatives:* International Standard Electric Corp., 67 Broad St., New York 4, N.Y.

APPLETON ELECTRIC PRODUCTS

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

Splice it BETTER!
QUICKER!
CHEAPER!
with NEW

POLYKEN*
ELECTRICAL ADHESIVE TAPE #822
Gives Unparalleled Performance in High-Frequency Installations

Compare these **Polyken** features

- **Dielectric Strength** Over 10,000 volts (9 mils thick)
- **Insulation Resistance** Greater than 8 x 10^6 megohms conditioned 24 hrs. @ 27° C—70% R.H.
- **Dielectric Constant** 2.6
- **Power Factor** .0050 (10^6 cycles)
- **Corrosion Resistance** No measurable corrosion effect
- **Solvent Resistance** No known solvent for No. 822's backing at room temperature
- **Corona Quenching Characteristics** Exceptional

*REG. U. S. PAT. OFF.

HERE AT LAST is a *single-material, all-purpose* electrical tape for high-frequency insulation and for splicing all high and low voltage circuits. Bauer & Black #822 *Polyken* Tape replaces combinations of splicing tapes or compounds with friction tape.

It will do everything these combinations do—only better, quicker, cheaper! Little is needed and No. 822 is but .009 inch thick.

POLYKEN #822 is made of polyethylene—an *oriented* plastic film—and a pressure-sensitive adhesive mass. Its dielectric strength is over 10,000 volts, and it is solvent resistant at operating temperatures. Recommended for splices on compression cable, aerial cable and for splicing paper-lead cable to plastic and rubber cable.

TEST SAMPLES and specifications furnished. No obligation. Address: *Polyken*, Dept. 5-8, 2500 S. Dearborn St., Chicago 16, Illinois.

A product of

BAUER & BLACK
Division of The Kendall Company, 2500 S. Dearborn St., Chicago 16
Industrial Adhesive Tape
PRESSURE SENSITIVE

Production Short Cuts to Reduce Costs • Research to Speed and Improve Methods

water absorption (ASTM), 0.26%; arc resistance (ASTM), 120 sec; and dielectric strength, 300 v per mil. Glastic is furnished in eleven thicknesses from $\frac{1}{32}$ to 1 in. in sheet sizes of 36x48 in.

•

Stranded Wire Clamp

FOR STRANDED WIRE and cable from No. 1 to 1000 Mcm in outdoor and indoor use, a two-bolt clamp is available from Jasper Blackburn Products Corp, St. Louis 6, Mo. The company advises that helical serrations in both body and cap, conforming to lay of stranded wire, increase the gripping and holding ability of this connector and produce efficient low resistance connection.

Made of high strength alloys, this clamp is small, compact and easy to tape and is recommended for deadending conductors. It also carries UL approval.

•

Slimline With Spotlights

HIGH-INTENSITY spotlighting plus direct-type general area lighting is provided by the CS-276, 8-ft Slimline luminaire made by Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa. Type 2SS-150 swiveling spotlight sections can be located at either end of the individually or continuously mounted Slimline units, or as separate sections.

The CS-276 uses four 8-ft slimline lamps and features instant-start, starterless operation. Top reflector assembly contains wired ballasts and lamp holders and is easily attached to housing.

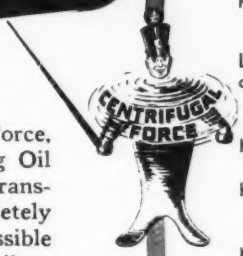
•

Alarm Silencer

TO ELIMINATE the danger of open hand-operated knife switches in alarm circuits, an Autocon alarm silencer, Type ABS, is made by Automatic Control Co. 1005 University Ave, St. Paul 4, Minn. The silencer may be used in circuits that indicate values of pressure, liquid level, temperature, smoke or gas overload.

When emergency condition arises, alarm is silenced by pressing button on side of sheet steel case. A red light remains on until trouble is corrected and the circuit is cleared. The unit then resets itself and the light goes out.

I Dehydrate Insulating Oil in a SINGLE PASS



"I am De Laval Centrifugal Force, working in a De Laval Insulating Oil Purifier. I purify and dehydrate transformer and circuit breaker oil completely at a single pass. Thus I make it possible for operators to maintain their oil at lowest cost and at highest efficiency."

When insulating oil is purified at a single pass, there is a greater daily output of thoroughly dehydrated oil, operating costs are lower, and the oil can be restored to a high dielectric value more economically.

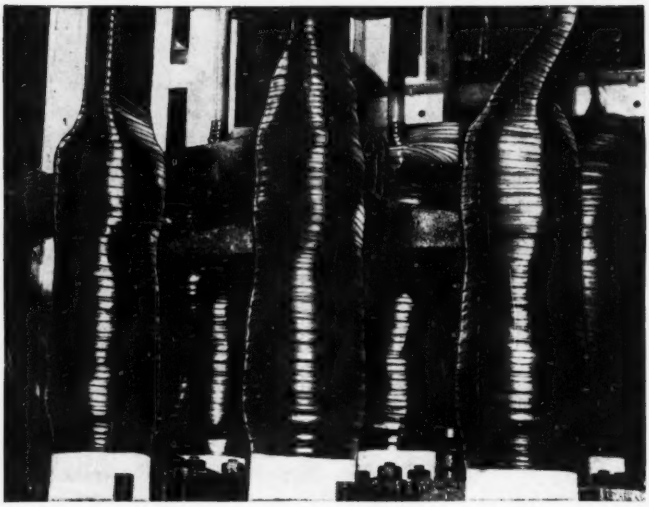
The reduction in water content is accomplished without the aid of a filter press. The press is used solely to remove colloidal carbon from circuit breaker oil.

ADVANTAGES OF DE LAVAL INSULATING OIL PURIFIERS

- Dehydrates at a single pass — no re-running
- Constant high purifying efficiency — no shutdowns for cleaning or for renewal of parts during run
- Safest — continuous discharge of water prevents re-contamination of the insulating oil
- Removes water without aid of filter press; press used only to remove colloidal carbon
- Low temperature purification; high dielectric value of oil maintained longer
- Heater cannot carbonize the oil
- Higher daily capacity of purifier saves maintenance costs
- More economical to operate

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval
INSULATING OIL PURIFIERS



FREQUENCY CHANGERS at Ohio works of the Carnegie-Illinois Steel Corporation. Power is brought into the plant at 2300 Volts 60 cycles, converted from 60 to 25 cycles and then stepped up to 6800 Volts to match the plant distribution voltage. Interconnections between breakers and outgoing leads total from 600 to 800 feet of single conductor bus work.

New plastic tape insulates high bus voltage at Carnegie-Illinois steel plant

High dielectric strength combined with compactness and single-step application makes "SCOTCH" No. 33 Electrical Tape ideal for wrapping and insulating bus structures of this type. This remarkable new plastic tape provides sure-fire protection against oils, acids, water and alkalies and is much easier to apply than conventional materials. Write Department EW-8 for free sample.

Quick Facts About "SCOTCH" No. 33 Electrical Tape

- **THIN CALIPER** — only .007 in. thick, takes less room in junction boxes and other tight spots.
- **HIGH DIELECTRIC STRENGTH** — over 7,000 volts.
- **WEATHER RESISTANT** — withstands sunlight, weathering and corrosive vapors — the worst enemies of rubber and varnish.
- **STRENGTH** — has a tensile strength of 40 pounds per inch of width.
- **STRETCHY** — conforms snugly to uneven surfaces, odd shapes. Elongation at break, 100%.
- **P.S.** — for High-Heat Insulation use "SCOTCH" Electrical Tape No. 27 with Glass Cloth Backing — Thermo-Setting Adhesive.

Made in U. S. A. by MINNESOTA MINING & MFG. CO. ST. PAUL 6, MINNESOTA

Also makers of other "SCOTCH" Pressure-Sensitive Tapes, "UNDERSEAL," "SCOTCHLITE," "3M" Abrasives, "3M" Adhesives.

General Export: DUREX ABRASIVES CORP., *New Rochelle, N. Y.*
In Canada: CANADIAN DUREX ABRASIVES LTD., *Brantford, Ontario*

Multi-Circuit Panelette

WITH MAIN DISCONNECT and branch circuits housed in one enclosure, MO panelette features "plug-in" circuit breakers and is made by Square D Co, 6060 Rivard St, Detroit 11, Mich. Panelettes are available in 12, 16 and 20-

circuit combinations for either 3 or 4-w service.

They have UL approval for "service entrance" use where circuit breaker mains are required. Thermal-magnetic circuit breakers "plug-in" on cylindrical bus bars. Boxes are 12 in. wide and 4 in. deep, permitting surface or flush mounting on shallow walls.

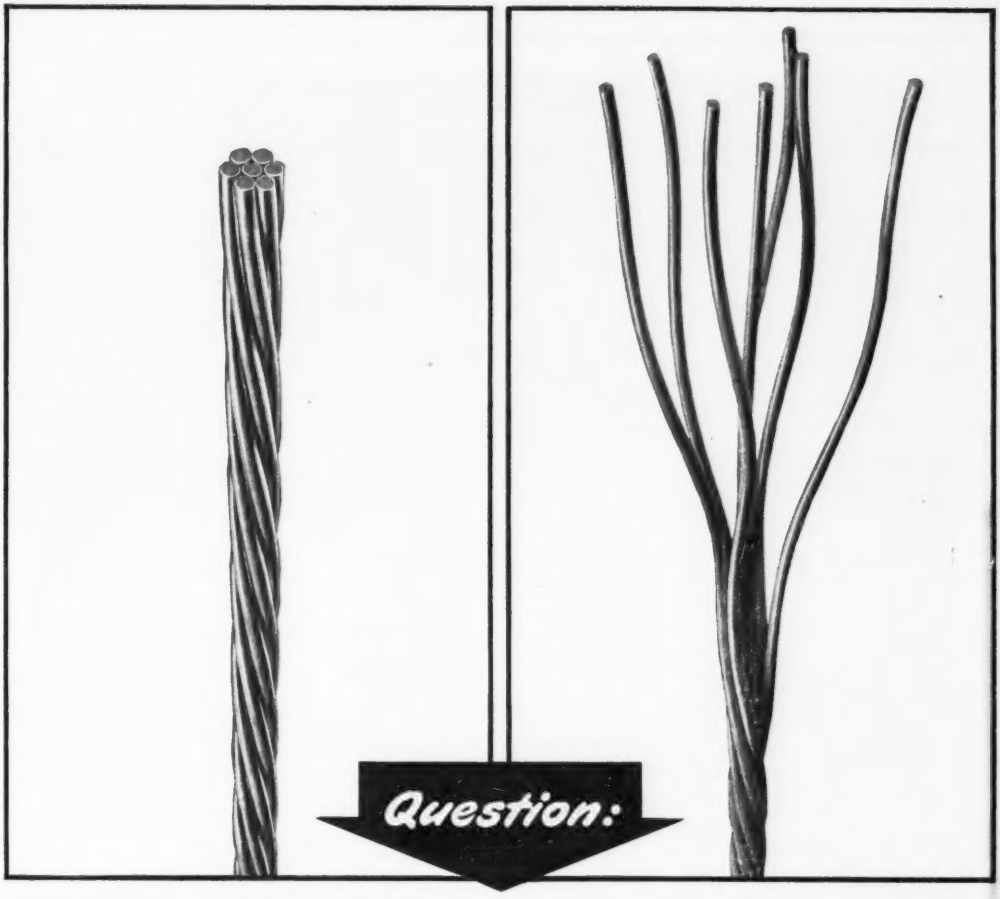
•

Totally Enclosed Motors

REQUIRING but little more installation space than open motors of like rating, Type CS, totally enclosed, fan-cooled, squirrel-cage motors, with copper fins embedded in the stator for additional cooling are announced by Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa. They are said to have electrical characteristics similar to those of standard, open squirrel-cage motors.

Copper fins embedded among the core laminations extend beyond core iron so that heat is transferred to external cooling air. Cylindrical copper and steel heat exchangers at both ends of the motor around the end turns transfer heat from internal air passing through rotor to external cooling air.

Motors are suitable for atmospheres contaminated with dust particles but are not designed for locations where foreign materials may obstruct ventilating openings. Type CS motors are available in ratings up to about 1,500 hp at 1,800 rpm, class B insulation, 75 C rise.



WHICH WOULD YOU RATHER WORK WITH?

The Form-Set strand on the left—with every wire smoothly in place? Or the strand at the right, whose wires spray out in every direction when the seizing is removed?

The answer, at least in part, can be gained from the pictures. Bethlehem's Form-Set strand is preformed; that is, each individual wire is preshaped before being laid together with its neighbors. The wires have no tense, inner urge to spring apart. Hence, when cut, the strand doesn't "unravel"; it keeps its original shape and compactness, even without seizing.

This means easier handling, faster work in the field. It means Form-Set is easier to insert in fittings. Linemen vouch for this preformed strand, because it enables them to work more swiftly and surely.

Something the pictures *don't* show is the low cost of Form-Set. The slight extra charge for preforming is so small as to be negligible. Its added advantages, therefore, cost you almost nothing.

All Form-Set strand has the ductile bethanized coating—a guardian zinc armor applied by Bethlehem's exclusive process. It is available in A, B, and C weights to meet atmospheric conditions in any given area. Ask a Bethlehem man for full details.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Bethlehem *FORM-SET* Strand

NEWS ABOUT PEOPLE

Gray-Donald Chosen New President of CEA

E. Donald Gray-Donald, chief engineer of Quebec Power Co and Quebec Railway, Light & Power Co since 1942, is the new president of the Canadian Electrical Association.

Elected vice-president were G. H. Thompson, Montreal Engineering Co, Montreal; T. Ingledow, British Columbia Electric Railway Co, Vancouver; and F. L. Lawton, Saguenay Power Co, Montreal. W. Booth, Shawinigan Water & Power Co, Montreal, was named treasurer.

E. D. GRAY-DONALD

Gray-Donald has been with Quebec Power since 1927. He has served as assistant superintendent and superintendent of power division, assistant general superintendent, and, from 1937 to 1942, general superintendent for both Quebec Power Co and Quebec Railway, Light & Power Co. His first Canadian job was with Shawinigan Water & Power Co, whose apprenticeship course he joined in 1926. Earlier he had worked at Vickers, Ltd, in London and had spent two years in general engineering work in Palestine.

•

Donald G. Fink, editor of *Electronics*, a McGraw-Hill publication, has been appointed chairman of the Joint Technical Advisory Committee by the boards of directors of the Institute of Radio Engineers and the Radio Manufacturers' Association. Formed jointly by the Institute and the RMA in 1948, the committee reviews and evaluates technical and engineering information relating to electronics in order to advise Government bodies and other professional and industrial groups.

•

A. G. Prangley Elected President of Buchanan

Arthur G. Prangley has been elected president of the Buchanan Electrical Products Corp, Hillside, N. J.

He has been executive vice-president of Buchanan, which is a partially owned subsidiary of the Elastic Stop Nut Corp of America. Prangley is vice-president and secretary of the latter company and a member of the boards of both.

ARTHUR G. PRANGLEY

Stephen N. Buchanan, founder of the Buchanan Corp, is continuing as director of research and development.

•

M. O. Stockland, Jr. advertising and sales promotion manager for the Four Wheel Drive Auto Co, Clintonville, Wis., has been appointed director of sales of the company. He succeeds **Robert L. Koehler**, who has resigned after 12 years of sales administration work with the company to join in a partnership with Oscar E. Betow and John E. Battes in the FWD Pacific Co, which distributes FWD trucks throughout the state of California. Mr Battes has left his position as FWD's western zone sales manager to join the partnership. The three partners have purchased FWD's Los Angeles branch.

McCormack Heads T & D Bureau for Consolidated

Electric and gas transmission and distribution engineering work of Consolidated Edison Co of New York, Inc, is being streamlined in a new organizational setup under the direction of J. Eliot McCormack, formerly staff engineer in the electrical engineering department. The new group will report to Charles W. Franklin, electrical engineer.

J. ELIOT McCORMACK

Mr. McCormack will head the new transmission and distribution bureau as chief distribution engineer. All of the engineering associated with transmission and distribution will be consolidated under the new bureau.

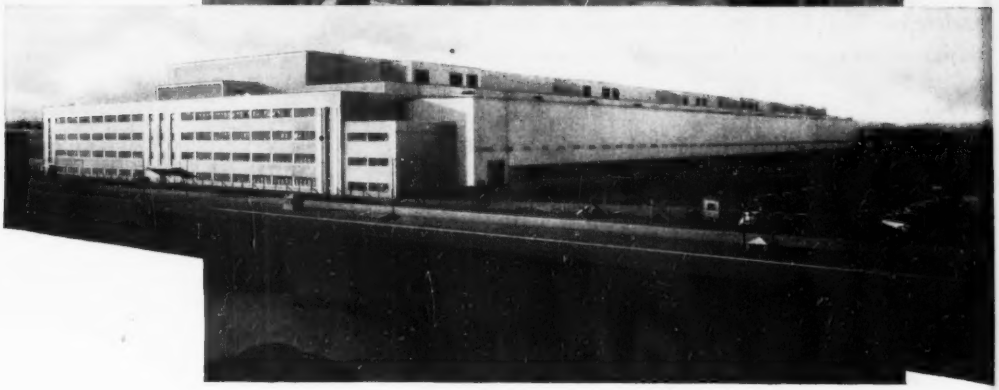
Mr McCormack began his career in the utility industry with the New York and Queens Electric Light & Power Co (now a part of Consolidated). He was serving as distribution engineer for Queens when he was transferred to Consolidated in 1938.

•

Walter J. Lyman has been appointed manager, planning and development department, Duquesne Light Co, Pittsburgh. **E. A. Hester** has been made consultant to the manager of the planning and development department. Entering the employ of Duquesne Light in 1924 as an apprentice engineer, Mr Lyman has since served the company as a junior engineer and assistant field engineer, engineering department, and as section engineer and engineering

THE WORLD'S LARGEST TURBINE PLANT

Interior of General Electric Turbine Building, Heavy Equipment Area.



To meet the growing power demands of industry, General Electric Company retained Stone & Webster Engineering Corporation to design and construct at Schenectady, New York, its new turbine manufacturing plant.

The building, which is 650 feet wide by 1290 feet long, has a total floor area of more than 1,000,000 square feet. It required foundation construction of unusual design to carry the heavy loads to be superimposed on the manufacturing floor, which comprises nearly 20 acres.

This plant when in full production will be capable of producing each month enough turbine-generators to supply power and light for a city of a million inhabitants.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY OF STONE & WEBSTER, INC.

Chance Anchors for Every Guying Need!

GET THE MOST FOR YOUR MONEY—SELECT ANCHORS FROM THE MOST COMPLETE LINE!

Whatever your guying requirement may be, there's a Chance Anchor that will do the job most efficiently. The Anchors shown here are made in a wide variety of sizes. Each type is designed for certain soil and guying conditions. Each of these anchors will do its specific job better than any other anchor you can choose. More than 13,000,000 have been put in service—*more than all other makes combined.*

Protect Your Investment in Line Construction. Select the *right* anchor for every condition . . . Your Chance Catalog will help you make the right choice. Or write for your copy of "How Much Will an Anchor Hold?" It tells how to determine the type and size of anchor to use for every guying condition.

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ABC INDUSTRIES

assistant to manager, planning and development department. Mr Hester became identified with Duquesne Light in 1926 as transmission planning engineer and subsequently became planning engineer and superintendent of planning and development department. From 1941 to 1944, he served with the War Production Board.

•

James Is New President of James G. Biddle Co

J. Robert James has been chosen president and D. Robert Yarnall, chairman of the board of James G. Biddle Co, Philadelphia.

Additional appointments include E. E. Lange, assistant sales manager; A. Q. Lange, technical sales engineer; T. B. Whitson, director of engineering; E. B. Curdts, assistant director of engineering; and Stuart C. Sommer, advertising manager.

James, who joined James G. Biddle in 1930, has been vice-president and treasurer since 1944. Earlier he had worked for J. E. Rhoads & Sons, Wilmington, Del. Yarnall, a past president of the American Society of Mechanical Engineers, had been president of the company since 1944.

•

Dr John Douglass Ryder, professor of electrical engineering and assistant director of the engineering experiment station, Iowa State College, has been named professor and head of the Department of Electrical Engineering, University of Illinois, effective Sept 1. He will succeed Dr William L. Everitt, who has become dean of the College of Engineering.

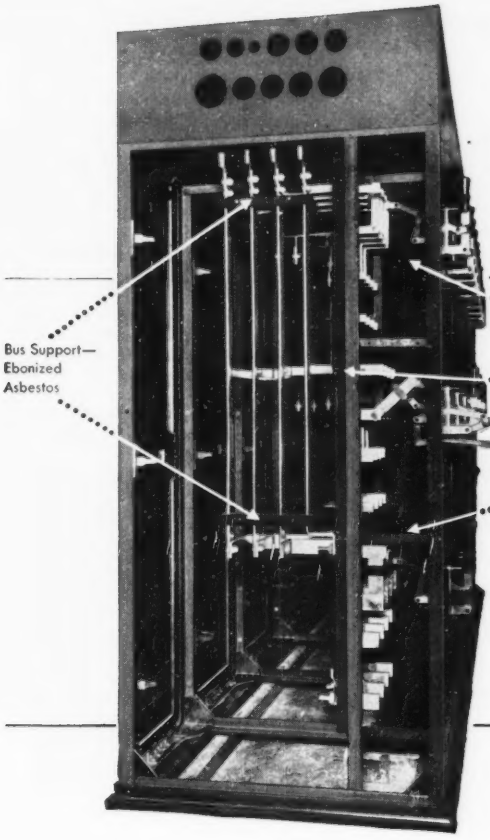
E. E. Ellis has been appointed manager of the motor and generator section of the electrical department of the Allis-Chalmers Mfg Co, Milwaukee. **V. J. Egan** has been made engineer-in-charge, motor and generator sales, and **H. H. Roth,** engineer-in-charge of large generator sales group. Mr Ellis has been with A-C since 192 : Mr. Egan since 1943 and Mr Roth since 1927.

L. V. James, veteran lighting engineer, has retired as district engineer for the Lamp Department of General Electric Co, which he joined in 1906. He will become a consultant in the lighting field. James formerly taught at the University of Illinois, from which he received his BS, MS, and EE degrees. He has served as chairman of the Chicago Lighting Institute's committee on lighting education and has been chairman of the Illuminating Engineering Society school lighting committee since 1944. He supervised preparation of the

K&M EBONIZED ASBESTOS

for electrical mountings

THAT GIVE YOU 3 HIGHS!



In addition to bus supports and mounting panels of K&M Ebonized Asbestos, this Pringle Switchboard has separators of K&M Monobestos—another versatile K&M material that betters electrical equipment.

High dielectric strength, high physical strength and high adaptability, all count in placing Ebonized Asbestos in much of the precise electrical equipment. Precision manufacture under high pressure, using specially developed raw materials, provides a product that can be readily machined, cut and drilled.

Pringle Electrical Manufacturing Company, Philadelphia, applies K&M Ebonized Asbestos to bus supports and mounting panels of the Dead Front Safety Knife Switch illustrated. The electrical safety factor is inherently high per unit of material. So is the mechanical safety factor, because there is strength in all directions with K&M Ebonized Asbestos. It particularly resists shock, vibration and temperature fluctuation.

These characteristics are valued by designers and engineers, for switchboard mountings, bus bar runs, compartment linings, test tables, bench boards and related applications. With K&M Ebonized Asbestos available in thicknesses from 1/8" to 4", any requirements can easily be met. For additional details write us; we'll answer you promptly.

Nature made Asbestos...

Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON

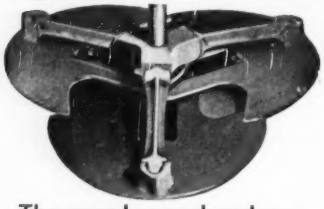
COMPANY • AMBLER • PENNSYLVANIA

In Canada—ATLAS ASBESTOS CO., LTD., MONTREAL, TORONTO, WINNIPEG and VANCOUVER

EVERSTICK ANCHORS...

First Choice for

PERMANENCE
HOLDING POWER
LONG LIFE
SAFETY



They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "The Anchor of Merit"
FAIRFIELD, IOWA

revised Standard Practices for School Lighting, approved last year by the American Standards Association.

•

J. H. Campbell Assigned New Executive Duties

James H. Campbell, formerly division manager of Consumers Power Co's Grand Rapids division, has been appointed assistant to the president and transferred to the general offices in Jackson, Mich. He will assist President Justin R. Whiting and Vice-President and General Manager D. E. Karn with general problems of company administration with particular reference to financial, economic and operating matters.

JAMES H. CAMPBELL

Mr Campbell joined Consumers in Lansing in 1933 as a power and lighting sales engineer in the Lansing division. From 1940-42 he was with the Ohio Edison Co in Youngstown. After spending four years in military service, he joined the Grand Rapids division of Consumers three years ago, first as assistant division manager and then became division manager.

His successor is **George W. Richel**, his assistant for the past two years.

Walter R. Coley, a vice-president of Leeds & Northrup Co, Philadelphia, has retired after 43 years' service with the company. Mr Coley joined Leeds & Northrup in 1906 as an instrument maker in the galvanometer section of the laboratory. His subsequent career carried him through positions of growing responsibility until in 1944, while the plant was running in high gear on war work, he was made vice-president in charge of production.

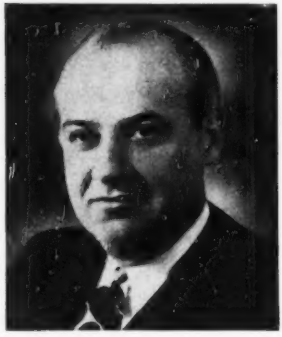
E. W. Gutelius has been named to direct advertising and sales promotion for the lamp and fixture divisions of Sylvania Electric Products, Inc, New York. He will be in charge of all promotional activities covering incandescent and fluorescent lamps, and fluorescent lighting fixtures and auxiliary parts. Formerly assistant sales promotion manager for the lamp department of the General Electric Co, Mr Gutelius has had wide experience in this field and in direct mail advertising.

•

Bennan Elected President of Jefferson Electric

J. M. Bennan has been elected president of the Jefferson Electric Co, Bellwood, Ill., to succeed James C. Daley, who has been made chairman of the board.

Mr Bennan is a son of John A. Bennan, who with Mr Daley founded the company in 1914 and who served as president from that time until 1943. J. M. Bennan, who has been executive vice-president, started with the company 16 years ago in a minor capacity as a production control clerk and has since acquired experience in the operation of every phase of the company's activities.



J. M. BENNAN

Other officers appointed include John R. Ford, vice-president and general sales manager; L. Mauerer, vice-president in charge of engineering; W. S. Minter, treasurer and V. E. Lee, secretary.

George I. Cohn, instructor in electrical engineering at Illinois Institute of Technology, has been made an assistant professor.

Warren S. Master has been appointed chief engineer of the Richardson-Allen Corp, New York. In his new capacity, Mr Master will have charge of all domestic and foreign technical operations of the company. For many years, he has been engaged in consulting and developing work in the utility, industrial

and aviation fields. Prior to joining Richardson-Allen as rectifier engineer in 1947, Mr Master was chief engineer, Hudson Tool Co, and rectifier development engineer, Federal Telephone & Radio Corp.

Albert W. Smith, formerly manager of the residential and small commercial sales section, sales department, Central Arizona Light & Power Co, Phoenix, has been appointed manager of the sales promotion and advertising section of the general sales department. Mr Smith has been with the company for 14 years as a salesman, lighting specialist, rate statistician, and government contract representative.

Charles Ganther has been appointed superintendent of the electrical department of the Cleveland Electric Illuminating Co, succeeding **Alfred H. Nicholson,** retired. Starting with the company in 1928 as a substation operator, Mr Ganther was made assistant superintendent of the electrical department in 1948. Mr Nicholson started his career with the company as a switchboard operator in 1905.

C. Fred Westin has been appointed assistant director of advertising of Public Service Electric & Gas Co, Newark, N. J. Mr Westin started with Public Service in 1947. Previously he was director of advertising and publicity for New Jersey Power & Light Co in Dover. During the war Mr Westin was civilian chief of public relations for Picatinny Arsenal where he directed the ordnance plant's publications.

Earl E. Grover, who served as director of claims, director of safety, and editor of the house organs, "The Illuminator" and "The Railiter", of the Columbus & Southern Ohio Electric Co, Columbus, has retired. From early boyhood, Mr Grover was associated with the railroad industry, where in later years he handled claim work. It was in this capacity in 1929 that he became identified with the utility company as director of claims, subsequently taking on the safety and magazine work.

OBITUARY

William E. Smith, 30, superintendent of the Linton, Ind., municipal electric department, died July 24.

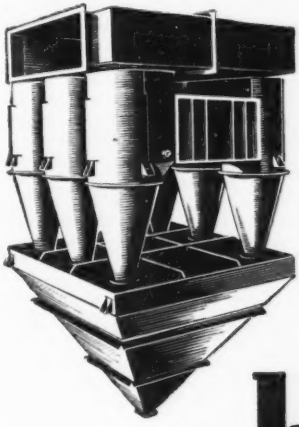
Newton Eugene Tryon, 74, Maumee, Ohio, co-founder of the old Maumee Valley Light & Power Co, died July 28 in Perrysburg, Ohio. He and his brother, the late Allan C. Tryon, started the utility 50 years ago, supplying the first electric power to Maumee and Perrysburg.

fly-ash

COLLECTION

can cost less

. . . **if you consider it logically,** day-by-day maintenance is just as much a part of cost as purchase price. Because Buell design is so essentially simple, long-range costs are relatively low. There is, in fact, *practically no maintenance* with a custom-designed Buell System. Each installation is designed for the *individual fly-ash problem;* such design combines the highest possible efficiency with simple, trouble-free operation. Large Buell cyclones won't interrupt operations by clogging, causing costly shutdowns...there's practically no need for attention. Yet these are not ordinary cyclones, for the patented van Tongeren 'Shave-Off' makes them considerably more efficient. The money-and-worry-saving facts are readable, complete and yours for the asking. Write for the new 32-page catalog to Buell Engineering Company, 70 Pine Street, Suite 5050, New York 5, N. Y.



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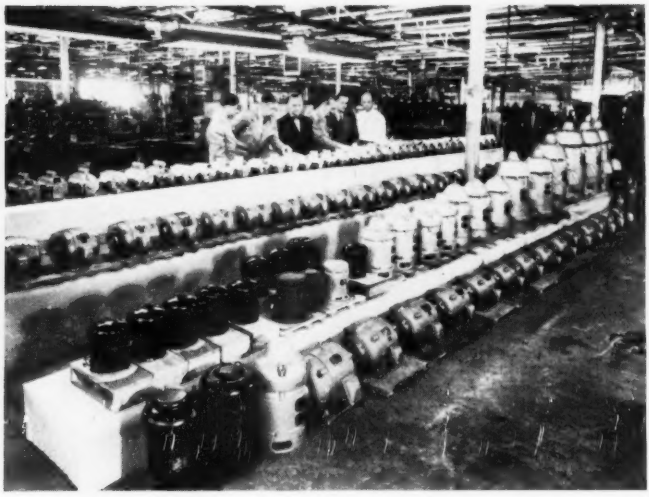
Manufacturing in the United States and Canada for shipment throughout North and South America.

MANUFACTURERS and MARKETS



NO TWO OF THEM alike, more than 100 motors are shown in the Los Angeles plant of the A. O. Smith Corp, Milwaukee, Wis. Both fractional and integral horsepower, single-phase and polyphase, the motors are used for driving machine tools, pumps, refrigeration equipment, floor machinery, and many other types of apparatus

Alcoa Constructing Wire, Cable Plant in Vancouver

Aluminum Co of America has awarded contracts for construction of an $300,000 aluminum rod, wire, and electrical cable plant at its Vancouver, Wash., reduction works. Operation is scheduled to begin next winter.

The new plant, covering four acres under roof, will manufacture aluminum transmission cable and also will have facilities for producing high-strength aluminum wire and rod products and screw machine stock.

•

Allis-Chalmers Earnings Increase in 2nd Quarter

Allis-Chalmers Manufacturing Co has reported net earnings for the second quarter as $1,999,445, equal to $1.87 a common share after preferred dividends of $292,000. For the first quarter of 1949 the corresponding figures were $4,877,983 and $1.82.

In the second quarter billings were $99,493,571 and bookings, $86,758,181. The billings for the first half of the year amounted to $190,272,742, and the bookings, $165,745,671. No comparison is made against the first half of 1948 because the effects of the 11 months' strike were still much in evidence.

Unfilled orders June 30 were $123,751,394 as compared with $136,486,784 as of the end of the first quarter of 1949.

•

Elliott Gets New Condenser Contract from Bonneville

Contract for construction of a newly designed 50,000-kva synchronous condenser to be installed at the Goshen, Ore., substation of the Bonneville Power Administration has been awarded to the Elliott Co, Jeannette, Pa., on a bid of $509,832.

Changes in design will permit the condenser, one of the largest ever built, to carry a 200% load up to 10 seconds and correct voltages during system disturbances much faster than standard types.

A hydrogen cooling system will permit continuous operation at 50,000 kva at 0.5 psi hydrogen pressure and up to 60,000 kva at 15 psi.

Operation of the condenser will tend to stabilize voltage for the entire southwestern Oregon power grid, it has been stated. The function of the condenser is to supply reactive current, essential to long-distance transmission, at the load centers instead of at the generating stations.

BPA plans call for additional condenser installations at other load centers when funds are available.

•

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Federal Electric Products Co. Newark, N. J., has appointed Curtis E. Remaly Cleveland district manager, with headquarters in the United Office Building.

A. B. Chance Co. Centralia, Mo., has appointed Fred B. Woods to represent it in the Southeast, working with W. A. Moss, sales manager of that division, with headquarters at 311 Candler Bldg, Atlanta 3, Ga. E. J. Higgins will work with C. T. Nevins, eastern division sales manager, with headquarters at 2003 Packard Bldg, Philadelphia, Pa.

Sylvania Electric Products, Inc. New York, has appointed Garlan Morse director of Pacific Coast sales for all product divisions of the company, with headquarters in San Francisco.

Buchanan Electrical Products Corp. Hillside, N. J., has appointed Felix Barnes, 686 Bruce St, Ridgefield, N. J., as sales representative in northern New Jersey and Staten Island.

Ward Leonard Electric Co. Mount Vernon, N. Y., has appointed Central Station Engineering Co., 2817 Croyden Drive, Tucson, Ariz., sales representative in the state of Arizona.

Graybar Electric Co. Inc. New York, has appointed T. A. Huston as Boston district appliance sales manager. Mr Huston will supervise appliance sales activities at Providence, Worcester, Springfield, Portland, Me., and Manchester branches as well as district headquarters in Boston.

Electric Service Manufacturing Co. Philadelphia, has transferred Walter Knodle from Dayton Ohio, to take charge of

Silicone News

DC SILICONES

Silicone Insulation Gives Rapidly Reversing Motor 10 Times Normal Life

That's significant news to designers of machine tools. Even more significant perhaps to electrical engineers is the further confirmation of our laboratory and motor test results. These tests indicated that Silicone Insulation has 10 times the life and 10 times the wet insulation resistance of Class 'B' insulation under comparable conditions.

PHOTO COURTESY COGSDILL TWIST DRILL COMPANY

Improved drill grinder depends upon DC Silicone Insulation for long trouble-free operation.

Engineers at Cogsdill Twist Drill Company of Detroit developed a unique machine for grinding drills. Instead of reversing the carriage by a conventional cam or crank, they use a 1 h.p., 1200 r.p.m. motor to reverse the carriage drive 50-60 times per minute.

In this service, Class 'A' insulated motors lasted 3 to 4 days; Class 'B' insulated motors lasted 3 to 5 weeks. After repeated failures, the reversing motors were rewound with DC Silicone Insulation by the A. H. Nimmo Electric Company of Detroit.

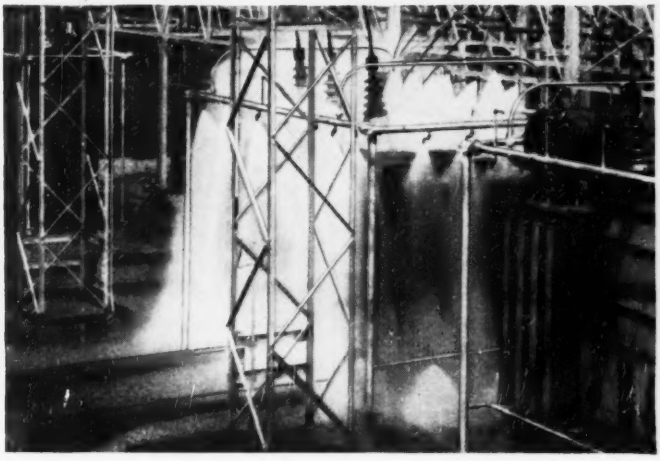
The motor bearings were packed with DC 44 Silicone Grease and the frame was painted with DC Silicone enamel. The motors have now been in service over 10 months and show no sign of failure. A hazardous smoke problem caused by the burning of conventional finishes also has been eliminated.

This is a typical example of how Dow Corning Silicone Insulation increases the life and reliability of hard working motors. Specifications for rewinding ac motors are given in sheet G6AB8.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN
Atlanta • Chicago • Cleveland • Dallas
Los Angeles • New York
In Canada: Fiberglas Canada, Ltd., Toronto
In England: Albright and Wilson, Ltd., London

Dow Corning
FIRST IN SILICONES

TRANSFORMER FIRES put out . . . *fast* with MULSIFYRE



When an oil fire breaks out in transformers protected by a Mulsifyre system, a battery of spray projectors puts out the fire . . . fast. Automatic, heat-actuated release devices assure quick operation. Extinguishment occurs within a few seconds after the emulsion-forming spray strikes the burning oil surface.

Mulsifyre projectors are approved by Underwriters' Laboratories, Inc. for extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard. There is no conductivity along the discharge of a Mulsifyre projector when the spray strikes conductors carrying high voltages.

Mulsifyre high-velocity projectors produce drops large enough and drive them fast enough to penetrate the flames without complete vaporization in flight, but limit their velocity so the surface of the burning liquid is agitated into an emulsion instead of passing through the oil without fire-extinguishing effect. After a period of time, the emulsion breaks down, oil and water separate, and the oil can be reclaimed.

Mulsifyre systems have proven their effectiveness during fifteen years of extinguishing transformer fires. Today they protect hundreds of installations all over the world.

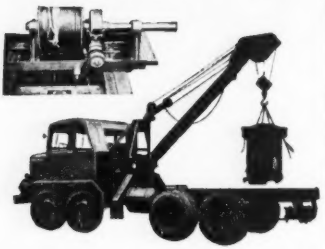
For information on Mulsifyre Systems write to: Grinnell Company, Inc., Providence, R. I. Branch offices in principal cities.

GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

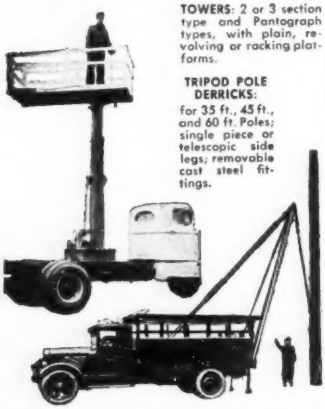
Utilities Have Specified
SILENT HOIST Equipment
• Since 1918 •

KRANE KAR Swing Boom Mobile Crane: for materials-handling . . . lifting, transporting, positioning, gasoline or Diesel, 1½, 2½, 5 and 10 ton capacities, 9 to 37 ft. booms (or telescopic booms), solid or pneumatic tires. Self-stabilizing without jacks or outriggers; unobstructed vision; fast, flexible, safe, easy to operate.



WINCHES: Capstans; Single and Double Drum, Jaw Clutch, Keyed and Friction Clutch Winches. 2,000 to 50,000 lb. Capacities.

SWING BOOM CRANES: Truck: Motor Power Operated; high capacity; takes up only a small space. For handling transformers, cable reels, lamp posts, trees, poles, manhole castings, etc. 9 to 31 ft. booms; one to 10 ton capacities.



TOWERS: 2 or 3 section type and Pantograph types, with plain, revolving or racking platforms.

TRIPOD POLE DERRICKS: for 35 ft., 45 ft., and 60 ft. Poles; single piece or telescopic side legs; removable cast steel fittings.

USERS: AT&T; N. Y. Tel. Co.; T.V.A.; Consolidated Edison Co.; W.U.; Municipalities throughout America.

WRITE FOR CATALOGS:

No. 79—KRANE KAR *No. 70—Truck Equipment*

THE ORIGINAL SWING BOOM MOBILE CRANE WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER
1½, 2½, AND 10 TON CAPACITIES
KRANE KAR
TRADE MARK REGISTERED
SILENT HOIST & CRANE CO.
862-63rd ST., BROOKLYN 20, N. Y.

the Detroit office, replacing John Mahler, resigned. Warren Erbe, previously connected with the Philadelphia office, succeeds Mr Knodle in the Ohio territory, with headquarters in Cincinnati.

Electric Machinery Mfg Co. Minneapolis, has appointed Alfred J. Kroog sales representative for the state of Georgia, with headquarters at 902 W. College Ave, Decatur.

General Electric Co has appointed Douglas B. Clark to head the recently created Florida sales district of the Lamp Department, with headquarters in Tampa.

MANUFACTURING BRIEFS

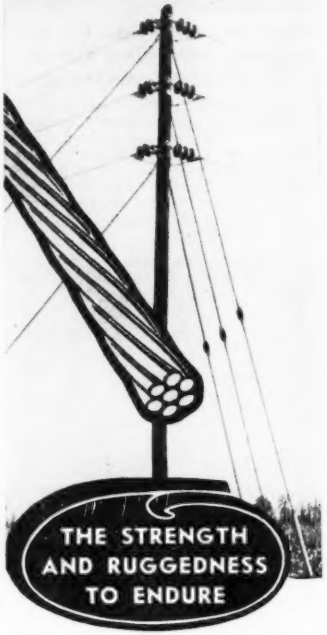
Baldwin Locomotive Works, Philadelphia, has been awarded the contract for two hydraulic turbines by the U. S. Army Engineers, Portland District. The turbines are for the Detroit Dam and are rated at 70,000 hp each, under a head of 285 ft, operating at 163.6 rpm. The total value of the contract is approximately $1,250,000.

Price cuts of 33⅓% on two models of Westinghouse electric irons, which are no longer in production, have been announced. Reductions were also made in the prices of Westinghouse's food mixer and two models of its waffle bakers. The lower prices were announced at the opening of the housewares show in Atlantic City.

Pakistan has placed the contract for delivery of its first major power generating equipment with Westinghouse Electric Corp—$900,000 worth of hydroelectric plant for the expansion of the Malakand station on the upper Indus River near the Afghan border. The order, according to McGraw-Hill World News, is for four 5,000-kw generators to be turned by four 7,100-hp reaction-type turbines working at 500 rpm on an estimated working head of 250 ft. When installed the new equipment will boost Malakand's capacity to 30,000 kw and make it Pakistan's largest single generating station.

Lincoln Electric Co has completed arrangements with The Austin Co of Cleveland for immediate construction of an $8-million plant in Euclid, Ohio. The one-story plant will contain more than 850,000 sq ft of floor area on a 65-acre site on St. Clair Ave between E. 222d St and Babbitt Road. The new plant will be ready in 1950 for the transfer of all manufacturing operations from the present plant, which will be available for sale or lease at that time . . . Imperial Electric Co, Akron, O., plans to consolidate the parent plant in Akron with the Middleport, O., unit. A new building with

Crapo
GALVANIZED STEEL
STRAND



STRENGTH to support the pole structure under maximum ice and wind loading . . . RUGGEDNESS to withstand the punishment incurred in construction and service . . . DURABILITY that outlasts the normal expectant life of the line . . . are combined—with important ECONOMY — in *Crapo* Galvanized Steel Strand.

Each size and grade develops the full tensile strength of the steel in cross section. The heavy, ductile, tightly-bonded zinc coating—applied by the famous *Crapo* Galvanizing Process—provides dependable protection for the steel.

ASK YOUR JOBBER!

There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA

35,000 sq ft of floor space will be erected at the site where the present Imperial buildings now stand . . . Electric Service Co, Greenville, Tex., has completed a 4,500-sq ft addition to its plant. This addition gives the company a total of 12,000 sq ft of floor space.

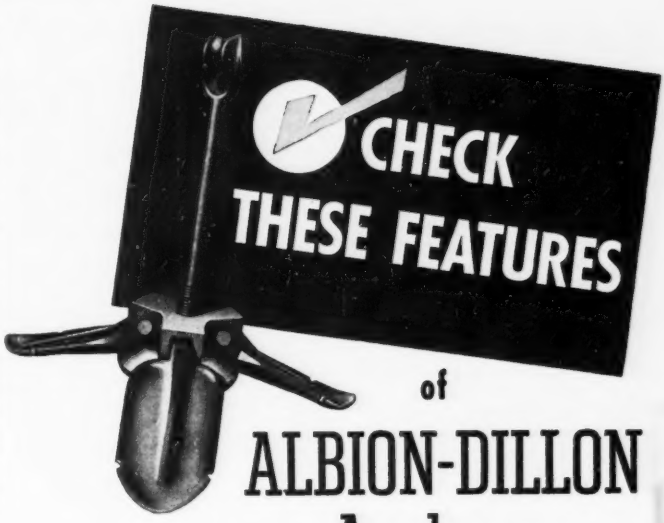
Reincorporation has been announced by the Utilities Electrical Machinery Corp under the name of Utilities Machinery Corp, with its new address National City-East Sixth Bldg, Cleveland 14, Ohio. Officers are J. W. Kohn, president; George Kohn, vice-president; and M. S. Kohn, general manager.

Allis-Chalmers has received an order for approximately $500,000, covering two 12,000-hp, 720-rpm synchronous motors with control and switchgear for driving the new 7x10-ft wind tunnel at the David Taylor Model Basin, Carderock, Md. Speed control over a range from 70 to 700 rpm will be obtained by use of magnetic coupling on each drive.

The history of the laundry industry from its origin in 1829, when Grandpa mailed his soiled stiff collars back to the manufacturer in Troy, N. Y., for refurbishing, to 1949, when thousands of pounds of washables are handled daily, is traced in "Allegheny Metal in the Laundry Industry," the latest in a series of booklets published by Allegheny Ludlum Steel Corp on stainless steel in various industries. The new 24-page booklet employs a wide selection of pictures, charts, and tables along with word descriptions to show how stainless steel has added to the efficiency and growth of the industry.

Phelps Dodge Copper Products Corp has announced it is issuing for the first time a new price list covering paper insulated power cables. This list covers the full range of voltages and conductor sizes for solid insulation types, as well as three-conductor low pressure gas filled cables.

Back from a five-weeks' trip to England, Sweden, Finland, France, and the Low Countries, J. L. VanNort, application engineer for the Reliance Electric & Engineering Co, Cleveland, reports that rehabilitation and modernization of European plants is proceeding most rapidly in those steel, paper, and textile industries where American machines, equipped with engineered drives and built-in precision electrical controls, are making possible higher operating speeds than manufacturers abroad have previously had available to them. Mr VanNort found a growing appreciation everywhere outside the Iron Curtain countries for American engineering "know-how" and equipment.



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ALBION-DILLON
Anchors

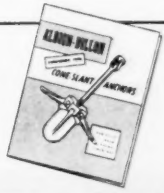
- Made of High-Strength Malleable Iron
- Economical in Price— Easy, Economical to Install
- Three Long Blades Extend Deeply in Solid Earth
- Lasting Strength Gives Them Lasting Holding Power
- Approved by R.E.A.— Selected by Leading Companies

For dependable guying under all conditions, rely on Albion-Dillon Expanding Type Anchors, made of malleable iron for *lasting* strength. Pull tests prove that A-D Anchors will withstand up to 46,000 lbs!

When you add up all the features, as listed above, you can understand why large companies are now specifying A-D Anchors in increasing numbers.

Send for Folder!

If you are not familiar with A-D Anchors, send for descriptive folder which includes specifications.



ALBION MALLEABLE IRON CO.
"One of America's Foremost Producers of Malleable Iron"
ALBION, MICHIGAN

here's the answer to your procurement problems

Obtaining and getting delivery of materials or equipment to meet your requirements is essential to prevent costly delays in your business operations.

That's why many companies are turning their problems over to EBASCO procurement—experienced purchasing, expediting, inspection and traffic men who see the job through *from start to finish*.

YOU GET WHAT YOU WANT

Purchasing men make nation-wide or world-wide search for products, machines, fabricating facilities. They write the contract on the best terms *for you*, and see that these terms are satisfactorily fulfilled.

PRODUCED—AS SPECIFIED

Expediters and inspectors keep your job moving on schedule through the supplier's plant . . . inspect and test materials, on the spot . . . make sure they're "as specified" before they leave.

DELIVERED ON TIME

Traffic men handle your shipment via any type of carrier—rail, water, express, highway or air . . . clear it all along the route . . . get it to where you need it, when you need it.

For procurement control you can depend on, turn your problem over to EBASCO. Our 40 years of accomplishment assures you of expert purchasing, expediting, inspection and traffic services.

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Systems & Methods · Taxes · Traffic

NEW ELECTRICAL CONSTRUCTION

A weekly selection of U. S. electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is indicated or implied

UTILITIES

Proposed Construction

Minn., Rochester—State Dpt. Admin. P. T. Peterson, dir. purchases, 19 State Capitol, St. Paul, furnish, install 2 stream generating units, furnish and install turbine generating units, surface condenser, State Hospital. Approx. $68,000. Plans deposit $10 each. Ellerbe & Co., E. 505 First National Bank Bldg., St. Paul, engrs.

Missouri—Southwest Electric Co-operative, R. H. Cochran, mgr., Bolivar, 488 mi. rural distr. lines Benton, Camden, Dallas, Green, Hickory and Polk Counties, Frank Horton & Co., Lamar, engrs.

Missouri—North Central Missouri Electric Co-operative, Inc., Milan, addnl. rural distr. lines conversion lines, sys. imprvs., Sullivan Co. **$810,000.**

Nebraska—Cuming County Rural Public Power Dist., West Point, rural distr. lines, Cuming Co. **$600,000.** Henningson Eng. Co., Standard Oil Bldg., Omaha, consult. engr.

Neb., Scottsbluff — Consumers Public Power Dist., Columbus, power plant expans., building addn. and power generating equip., etc. Approx. **$1,000,000.** Ray Schaecht, c/o owner, engr.

N. Y., New York—Consolidated Edison Co., 4 Irving Pl., Zone 3 electrical distr. substation and pump house at 236-38 Cherry St. **$130,000.** Theron R. Galloway, c/o owner, engr.

N. Y., New York—Dpt. Pub. Wks., Municipal Bldg., Zone 7, general constr.; plumbing; electrical for power plant expans., Phase B, combined steam tunnel and sea wall, stage 2, at Welfare Island. Plans deposit $25.

Oklahoma—U. S. Eng., P. O. Box No. 61, Tulsa, Zone 2, design, mfg., delivery f. o. b. railroad cars at Gore, installation in the powerhouse and testing two 17,895 kva. alternating current generators for the Tenkiller Ferry Dam power plant on the Illinois River, near Gore, Inv. No. CIVENG-34-066-56-8.

Oregon—Bonneville Power Admin., 792 N. E., Oregon St., Portland, East McMinnville sub-station and control house. Inv. 4760. Plans deposit $25.

Ore., Monmouth—State Bd. Higher Educ., University of Oregon, Eugene, light and power distr. sys. for Oregon College of Educ. Plans deposit $25. Cornell, Howland, Hayes & Merryfield, Rennie Bldg., Corvallis, engrs.

Tex., Austin — City, Guiton Morgan, mgr., City Hall, construct main electric power plant, $2,000,000. Plans deposit $40. Electric power sub-station, **$300,000;** electric power distr. lines, **$300,000.** Burns & McDonnell, Engr. Co., 95 and Troost Sts., Kansas City, Mo., consult. engrs.

Washington—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., power transformer, Horn-Gap switch and disconnecting fuses for Quindy Pumping Plant, Switchyard, Columbia Basin Proj. Spec. 2696. L. N. McClellan, ch. engr.

Low Bidders & Contracts Awarded

Fla., Jacksonville—City, City Hall, supplying, install approx. 15,000 ft. submarine cable and accessories, for Power Plant No. 2, Southside with city's main generating plants and underground distr. sys., to Miller Electric Co., 247 Riverside Ave., and Henry Ihle, Chicago, Ill., **$1,823,000.**

Fla., Tampa—Florida Power Corp., 101 5 St. S., St. Petersburg, power plant, to Kuljiam Corp., 1220 N. Broad St., Phila., Pa. Approx. **$500,000.**

Ind., Crown Point—Northern Indiana Public Service Co., 5265 Hohman Ave., Hammond, 50x70 ft. brick, steel central station to Fred C. Rowley & Sons, 4732 Calumet St., Hammond, **$175,000.** Hutton & Hutton, 5231 Hohman St., Hammond, archts.

N. C., Concord—City, Bd. Light & Water Comrs., Concord, electrical distr. sys. imprvs. to Harrison-Wright Co. Inc., 116 W. 3 St., Charlotte, **$118,313.** Bids 6/28.

N. C., Wilson — Town, L. Faulkner, mayor, Wilson, July 14, power plant imprvs. Sec. 1 constr. addns., alterations to existing turbine room, incl. fdns. from Crain & Denbo, Inc., Durham, **$124,860.** Wm. C. Olsen, 6 Exchange Pl., Raleigh, engr.

Oregon—U. S. Eng., 19 E. Poplar St., Walla Walla, Wash., July 29, two 3 750 kva. alternating-current generators, appurtenances for McNary powerhouse, Serial No. Eng.-45-164-49-121, from Electric Machinery Mfg. Co., 1331 N. E. Tyler St., Minneapolis, Minn., **$155,132.**

Pa., West Mifflin—Westinghouse Electric Corp., Atomic Power Div., West Mifflin, 1 and 2 story, 130,000 sq. ft., masonry, and steel main laboratory and office bldg. at Bettis Field site, to Ragner Benson, Inc., 4744 W. Rice St., Chicago, Ill., **$1,690,637.** Bids 7/13.

Washington—Bureau Reclamation, Dpt. Interior, Ephrata, Burbank Pumping Plant 1; 115-kv substation; 13.2 kv switchyard; concrete discharge pipe, at Odair, Spec. R1-CB-16 (Region 1), Columbia Basin Proj., to Pfeiffer & Hohner, 6203 E. Sharpe Ave., Spokane, **$97,944.**

Wash., Richland—U. S. Atomic Energy Comn., 1901 Constitution Ave. N. W., Wash., D. C., electrical construction in business district, to Howard P. Foley Co., 240 E. 1 South St., Salt Lake City, Utah, **$39,852.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Del., Wilmington — Sears, Roebuck & Co., Roosevelt Blvd. and Adams Ave., Phila., Pa., retail store, farm store and service station, $2,000,000. The Ballinger Co., 121 N. Broad St., Phila., Pa., archt.

Ill., Chicago—1350 Corp., c/o Draper & Kramer, Inc., agts., 18 W. Washington St., Zone 2, plans by Loebl Schlossman & Bennett, 333 N. Michigan St., Zone 11, 21 story, steel, brick, concrete apartment, incl. 740 units, 1350 N. Lake Shore Dr., **$7,000,000.**

O., Cleveland—National Advisory Com. for Aeronautics, Administration Bldg., Brookpark Rd., 2 story, brick and block propulsion sciences operations bldg., at Brookpark and Greyton Rd. $10,000,000. Burns & Roe, Inc., 223 Broadway, New York, N. Y., archts.

Pa., Phila.—Lankenau Hospital, Corinthian and Girad Aves., plans by Vincent G. Kling, 917 Corinthian Ave., hospital at Overbrook, **$6,000,000.** George M. Ewing, Western Saving Fund Bldg., Broad and Chestnut Sts., assoc. archts.

Tex., Houston—H. K. Ferguson Co., M & M Bldg., 8 story masonry, steel, commercial bldg., San Jacinto and McGowen Sts. **$2,000,000.**

Low Bidders & Contracts Awarded

Calif., Whitewater — S. A. Guiberson, Jr., 2361 Hollyridge Dr., Los Angeles, cement mill, to McNeil Constr. Co., 5860 Avalon Blvd., Los Angeles. Approx. **$15,000,000.**

La., New Orleans—U. S. Eng., foot Prytania St., Aug. 2, 10 story main bldg., U. S. Veterans Admin. Hospital, from Robert E. McKee, 2708 Inwood Rd., Dallas, Tex., **$7,687,000;** elevators, from Otis Elevator Co., 810 18 St. N. W., Wash. 25, D. C., **$349,975.**

N. Y., New York—Uris Bros., 730 Fifth Ave., Zone 19, 25 story office on east side of Madison Ave. from 56 to 57 Sts. Owner builds. **$6,000,000.**

CATALOGS • BULLETINS

● ISOLATORS: A new 40-page bulletin, (Bulletin No. 140), provides a complete listing, indices, reference dimensions, photographs and other data, including method of operating, typical installations and applications. Electrical Engineers Equipment Co, Melrose Park, Ill.

● CONNECTORS: Photographs in color, technical data for use and installation, and engineering information are contained in an 80-page bulletin on electrical lugs and connectors. Other material important for use in production and maintenance is included. Ilsco Copper Tube & Products, Inc, Mariemont, Cincinnati 27, Ohio.

● TRANSFORMERS: Bulletin No. 210-01 points out the principal features of design and manufacture of the AmerTran distribution transformer. This eight-page, highly illustrated booklet also contains dimension, tables and mechanical data. American Transformer Co, 178 Emmet St., Newark 5, N. J.

● SWITCHGEAR: Feature of this eight-page bulletin is the illustrated description of a typical heavy duty control center in use at one of the world's largest hydro-electric developments. Drawout, vertical lift and stationary type breaker types are illustrated in the bulletin. Northeastern Engineering Inc, Manchester, N. H.

● MOTORS: BULLETIN PB 7000-1 describes new two-pole, 250-3,500 hp, Fabri-steel induction motors. These motors may be the drip-proof, splash-proof, enclosed self- or separately-ventilated types. Sleeve bearings are ring-oiled for motors 900 hp and smaller, pressure-lubricated for motors 1000 hp and larger. The 23 illustrations in this four-page bulletin explain details of construction. Elliott Co, Jeannette, Pa.

● SWITCHES: Publication 4807 describes the new "MK-40" switch, a vertical break, rotating insulator type switch. This four-page booklet lists the improved thermal characteristics and describes the fully controlled blade movement. All standard voltage and current ratings to 230 kv and 1,200 amp are listed. Publication 4811 describes, with illustrations, the two general classifications of automatic switching with motor-operated air-break switches, transfer schemes and sectionalizing schemes. Publication 4806, describes high capacity disconnect switches, "B-2P" and "FB-2P", which are available in standard 7.5, 15, 23 and 34.5-kv ratings. Ampere capacities are 2,000, 3,000, 4,000 and 5,000. Delta-Star Electric Co, 2400 Block, Fulton St, Chicago 12, Ill.

● FARM EQUIPMENT: An 88-page catalog, describes all the farm-home products—major and traffic appliances, radio and television equipment, also farm equipment, construction materials, lighting, heating and air conditioning equipment. A special section is devoted to the General Electric Home Bureau which can assist farmers and their wives in planning complete electric kitchens and laundries. General Electric Co, 1285 Boston Ave., Bridgeport 2, Conn.

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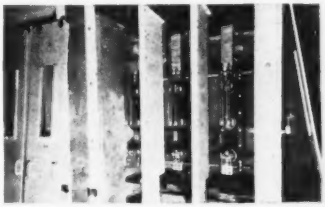

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TECHNICAL LITERATURE

Color Study—"Color is How You Light It" is a booklet giving the results of a study on determining which of the six different tones of white light now available are best suited to different colors of paints and fabrics. A two page chart notes the appearance of 44 decorating colors under each of the six artificial light sources. The publication has been issued by the Commercial Engineering Dept, Sylvania Electric Products, Inc, 500 Fifth Ave, New York 18, N. Y.

Nitralloy Steel—An eight-page engineering bulletin describes Nitralloy and includes a table of compositions, hardness curves, mechanical properties, information on nitriding and heat treatment and typical applications. Copies may be secured from Joseph T. Ryerson & Son Inc, Box 8000-A, Chicago 80, Ill.

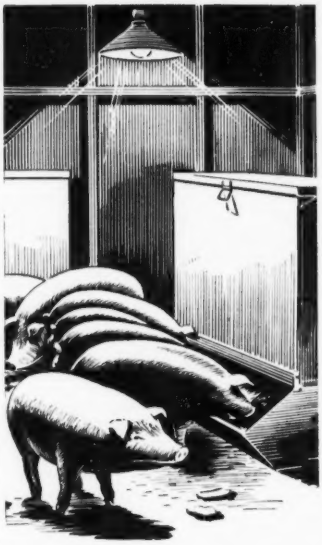
Piping—"Metallurgy and Piping, 1948" is a report outlining very briefly some activities of various organizations interested in piping materials. Some subjects are creep, graphitization, corrosion of stems in small valves, and welding procedures of pipe materials that will operate at 1,000 F and 1,050 F. Known as publication R-7, copies are obtainable from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y., at 60¢ to members and their employees.

X-ray Protection—"Medical X-ray Protection up to Two Million Volts" is National Bureau of Standards Handbook 41, obtainable, at 15¢ per copy, from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Rules are given for working conditions, survey, inspection and planning of installations. A chapter on electrical protection treats such topics as high-voltage circuits, grounding inspection and maintenance, warnings and instructions, in first-aid and fire-extinguishing devices.

Welding—To formulate a suitable, standard terminology for welding, "Standard Welding Terms and Their Denitions," publication A3.0-49, has been made available at $1 per copy. Also available are a "Master Chart of Welding Processes" listing all 37 welding processes in commercial use today and Process Charts camparing the processes on the basis of similarities and differences of 24 fundamental characteristics. These charts are publication A3.1-49 available at 35¢ per set of five. Both publications can be obtained from American Welding Society, 33 West 39th St, New York 18, N. Y.

Magnesia—A 96-page manual on 85% magnesia insulation covers subjects such as determination of correct thickness, application and finishing procedures, and insulation maintenance. The appendix contains definitions of terms, 15 tables of data, and a glossary of trade terms. The publication is scheduled to be available in July. Requests for copies are to be made on business letterhead, giving title of individual making the request, and should be sent to Magnesia Insulation Manufacturers Association, 1317 F St, N. W., Washington 4, D. C.

Voltage Rating—"EEI-NEMA Preferred Voltage Ratings for A-C Systems and Equipment" is a joint committee report covering voltages from 120 to 230,000. Tables give preferred nominal system voltages and preferred voltage ratings. Copies may be obtained at 70¢ each in the U. S. A., as publication R-6 issued by Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y., or as publication 117 issued by National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y.



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BOOK REVIEWS

Industrial Electricity. Volume II—Alternating Currents. By William H. Timbie, Professor Emeritus of EE and Industrial Practice, MIT and the late Frank G. Willson, formerly Head of Applied Electricity, Wentworth Institute. Published by John Wiley & Sons, Inc, New York 16, N. Y. 781 pages, illustrated. Price $5.96

This textbook for technical schools discusses alternating-current theory and practice as applied in industry, and includes 500 diagrams and other illustrations. In the book, each new concept is developed by: (1) Stating "what happens"; (2) explaining "why it happens"; and (3) working out practical examples with the aid of circuit diagrams and vectors. About 900 problems for class use are included.

Industrial Electronics and Control. By Royce Gerald Kloeffler, Head, Dept of EE, Kansas State College. Published by John Wiley & Sons Inc, New York 16, N. Y. 478 pages, illustrated. Price $5.50

This college textbook surveys the theory and applications of electronics in industry. The first eight chapters comprise an introductory course in electronics, including: Electron emission, vacuum drodes, grid control, electrical conduction, gaseous tubes, photo electricity, and metallic rectifiers. The remaining 14 chapters discusses major applications in the industrial and commercial field. Topics include: Control circuits, servo-mechanisms, high-frequency heating, rectification and inversion, resistance welding, electrostatic precipitation, motor control, photo-electric control, electronic regulators and x-ray applications. The volume is well illustrated. Typical problems are at the end of each chapter.

Induction Heating. By N. R. Stansel, formerly Industrial Engineering Consultant, General Electric Co. Published by McGraw-Hill Book Co, New York 18, N. Y. 212 pages, illustrated. Price $3.50

A professional presentation of electrical and thermal principles of eddy current heating and their practical application in industry.

Most basic equations in the book have a curve showing results of varying its parameter. Much data are included on the resistivity values of metals at the temperatures specified for heat applications. Economic aspect of selection of frequency and importance of the work-coil are stressed from the viewpoint of modern design practice. The eight chapters are titled: Introduction; Heat; Induction Heaters-Class A Service; Circuit Equations; Circuit Analysis; Applications-Class A Service; Melting Metals-Class B Service; and Power Circuit Conductors-Machine Frequencies.

Electrical Transmission of Power and Signals. By E. W. Kimbark. Published by John Wiley & Sons, Inc., New York 16. 461 pages, illustrated. Price $6.

Unity of transmission is achieved by the author in the sense that power, telephone, carrier and radar are brought into one pattern with clear exposition of the common basis. Skin effect, mutual inductance, coupling are treated before taking up the characteristics of commercial conductors including ACSR, hollow conductors, buses in overhead and ground return circuit. Hyperbolics of smooth and lumpy lines and transients precede the matter of voltage regulation, power circle diagrams, etc. The latter half then deals with carrier, cables, telephone, filters, wave guides. Extensive tables of conductor and live line characteristics are compiled in the appendix.

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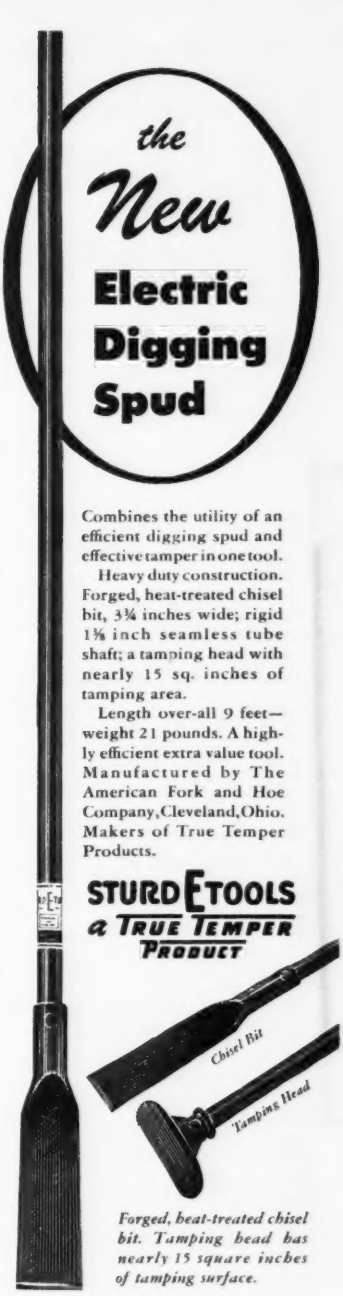

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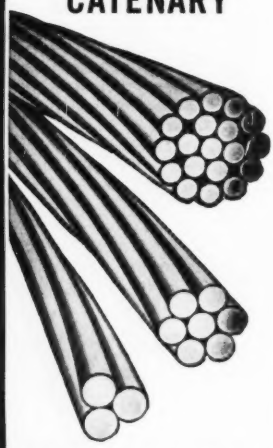

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Power Capacitors. By R. E. Marbury. Published by McGraw-Hill Book Co., Inc., New York 17. 205 pages, illustrated. Price $3.50.

Users of capacitors often have inadequate understanding of the problems of the designer in choosing and applying paper and foil effectively, economically and durably in fabricating the capacitors. Here one can learn how they are made, how they are applied on utility systems, in industrial plants, for energy storage welding, for power factor correction and voltage regulation, what accessories go with them and how they can be controlled automatically. There is plenty of numerical help in the charts and in the typically solved problems to facilitate intelligent application.

Wake Up Brother! By E. W. Elmore. Published by the author C O Burns Cuboid Company, Santa Ana, California. 20-page booklet. Price, single copy 25¢, reducing in steps to 10¢ for over 100

Designed specifically to put sales people on their toes by pointing out to them that the buying days are past and the selling time is here. Written in vigorous language, it compresses the principles of salesmanship into capsule space. Should be useful for distribution to selling personnel.

Heating, Ventilating and Air Conditioning Guide. Published by American Society of Heating and Ventilating Engineers, New York 10. 1384 pages, illustrated. Price $7.50

This is the 27th annual edition with revisions and additions to 24 of the 52 chapters. As has been the custom the contents are what some would consider worthy of the designation "handbook" but the inclusion of nearly 400 pages of catalog data and manufacturer listing makes the term "guide" more descriptive.

The electrical engineer will find the basic principles of heating and the authentic quantitative information of the art here —no matter what the medium or the system. Naturally most of the system discussion deals with competitive processes but of specific interest should be the chapters on district heating, electric, panel and radiant heating, fans, refrigeration, drying. The heat pump (not indexed) is treated under reversed refrigeration. A cover pocket carries a large reproduction of the Goff diagram for moist air. The ASHVE comfort chart appears in the chapter on physiological principles.

Magnetic Recording. By S. J. Begun. Published by Murray Hill Books, Inc, New York 16, N. Y. 242 pages, illustrated. Price $5

Beginning with a history of the art, moving to a discussion of the acoustic and magnetic technology and thence to the techniques of recording the book proceeds to a discussion of the component functions of the equipment available. The subject matter at this point in conjunction with the ensuing treatment of the forms of recorders available gives the reader a fine insight into the refinements of the art. The equipments described in detail are of numerous and diverse origins as well as of the producer with which the author is associated.

Maintenance Manual of Electronic Control. By R. E. Miller. Published by McGraw-Hill Book Co, Inc, New York 18, N. Y. Price $4.50

Electrical Construction and Maintenance carried a series of articles by General Electric engineers explaining how electronic and electric technicians can intelligently maintain electronic control equipment. This book assembles those articles about cathode-ray oscillographs, relays, motors and welding controls, temperature controls and seal-ignition rectifiers. Emphasis is recognition of symptoms and choice of correctives in practical terms.

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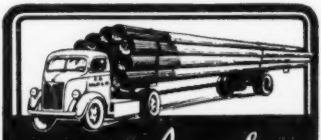

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LETTERS TO THE EDITOR

Hydro Capacity in India

To the Editor of ELECTRICAL WORLD:

Our attention has been drawn to the following extract from the "ELECTRICAL WORLD" dated December 28th, 1948 (page 3).

"U.S. electric utilities worried about the high cost of new generating capacity better send some men to India to study the books on the Damodar Valley Project. The plan there is to irrigate 763,000 acres, install 2,000,000-kw of hydro and 1,050,000-kw of steam, all for "nearly $165,000,000". Assuming that the irrigation comes free, that's only $54 per kw. Indian Government representatives insist the figures are ok".

The correct figures Hydro and Steam are 200,000-kw of hydro capacity and 150,000-kw of steam capacity. The capital outlay of $165,000,000 corresponds to Rs. 55 crores, as given in the "Preliminary Memorandum on the Unified Development of the Damodar River" issued in August, 1945, a copy of which is attached.

It will be greatly appreciated if you will please get the figures corrected in a subsequent issue of your journal.

T. P. Singh
Deputy Secretary
Damodar Valley Corporation
Alipore, Calcutta

Sparrows See the Light

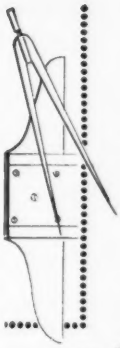
To the Editor of ELECTRICAL WORLD:

You will probably be interested in the following experiences with sodium street lights—we have operated 50 NA9 10,000 lumen GE sodium lights for a number of years on US Highway No. 25 which runs through Greenwood.

About one half of these lights are south of the business section and the other half north. It happened that the fixtures on the south side faced west and the north side fixtures faced east.

During the spring and summer we simply have not been able to keep the English sparrows from building nests in the south side fixtures, but we have had no nests built in the north side units. Within the last few weeks, due to rebuilding of the highway, the south side fixtures have been faced to the east like the other fixtures have always faced. We have no more sparrow nests. Thus we conclude that the English sparrow is not a Mohammedan.

F. W. Chapman, Superintendent
Commissioners of Public Works
Greenwood, S. C.



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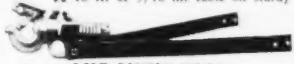

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It Need Not Happen Here

To the Editor of ELECTRICAL WORLD:

Attached is a copy of an editorial taken from the June 7 issue of the Albert Lea Evening Tribune. This is a very good editorial on the socialization of electricity, which you may think worthy of reprinting in your ELECTRICAL WORLD Magazine.

C. E. Myers
District Manager
Interstate Power Co
Albert Lea, Minn.

Avoidable Tragedy

"The largest expansion program ever undertaken by any industry is now being pushed by the private electric companies of the nation. It is at the halfway mark. Its total cost will be some $9,000,000,000.

"One of the remarkable things about this huge expansion program is that the industry has had the will to do the job at a time when a bitter, government-backed campaign is being carried on to destroy it. It is the best possible evidence of the industry's progressive and farsighted spirit. The kind of faith in the future which made possible the creation of the industry, at a time when die-hards viewed electricity as nothing more than an amusing and dangerous fad, is still in existence.

"Here is the complete answer to those who say government development and socialization of power is necessary to our present and future energy needs.

"What would happen if Congress didn't appropriate another penny for socialized electricity—and so took a heavy burden off the backs of the taxpayers? The utilities would simply readjust their plans, reset their sights, and go ahead with the task of providing well in advance for all our power needs. All the money would come voluntarily from private investors, new and important sources of taxation would be created, and the power would be sold at rates held to be fair by public regulatory bodies.

"Socializing any kind of enterprise is a tragedy that doesn't have to happen here."

Lighting Costs

To the Editor of ELECTRICAL WORLD:

Your article on Fluorescent Lighting Costs by R. G. Slauer, which appeared in the April 23 issue, is an interesting one in that it compares the different types of fluorescent lighting. However, there appears to be one basic fallacy in the method of presentation of these lighting costs. The comparison was made on the basis of lumen output of the different types of light sources, with no regard to the brightness.

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Mr. Wagner is a Consulting Electrical Engineer with the American Association of Engineers in Chicago, Illinois. As such, he is in constant need of specific buying information on all types of electrical machinery, equipment, supplies and services.

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Lineman's Tool Bucket

STANDARD EQUIPMENT WITH LIGHTING POWER AND TELEPHONE COMPANIES

•

For hoisting tools, insulators and supplies. Heavy-weight hard woven canvas with five-ply cross-grained marine plywood bottom. Rope loop for hanging over pin. No metal parts to come in contact with current.

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Write for Bulletin B-89

Safety Equipment for all Industries

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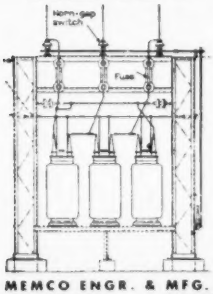
MEMCO (SINCE 1915)



SUBSTATIONS

OUTDOOR & INDOOR SWITCHES

CONNECTORS

SLEEVES

FITTINGS

MEMCO ENGR. & MFG. CO., INC.

37-48 61 STREET WOODSIDE, L. I., N. Y.

SCRU-ITS

U. S. Patent No. 1,933,555

SOLDERLESS

WIRE CONNECTORS

FAST! EFFICIENT! ECONOMICAL!

STRIP ENDS!

SCREW IT!

THAT'S ALL WITH SCRU-ITS!

WRITE FOR DATA SHEET NO. 1100

SOLAR ELECTRIC CORPORATION

WARREN, PA.

Following this procedure, it is obvious that, all other things being equal, the most economical light source would be the one in which there was a high concentration of light per unit length, with the resultant surface brightness.

Now, if you consider the brightness of the light source in making an economic comparison, the results would be entirely different. I think you will find that the cold cathode light source, because of its long life and low surface brightness, would be the most economical in the long run.

After all, since we consider quality as well as quantity of light when making an installation, why don't we do the same thing when making a cost comparison?

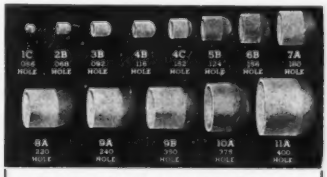
The Fluorescent Lighting Assn
New York City

Government Control

To the Editor of ELECTRICAL WORLD:

Your editorial on "Crane Hazards" reflects an attitude of the American citizen that will bring this country to the dogs in spite of the best efforts of every "Dollar-a-year" man, past, present, and future. Why waste the taxpayers money with another ding-dong, dad-blasted paternalistic "administrative regulation"? Either the crane operator is negligent, or the power company is negligent, when the 33-kv line goes up in a ball of fire. Since when has it been necessary to have legislation of this kind for a basis of action in a civil court? For my money, this law, regulation, imposition on good, common sense, or whatever it should be tagged, is just one more step toward government control of industry. If you want private enterprise to continue to exist, it don't make sense to swear at the man forging the ax-head, and cheer for the man whittling the handle. Cuss the both of 'em.

J. B. Lankes
Hilton Village, Va.



STAR INSULATING BEADS

Use LAVOLAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality beads at low cost. Quickly applied. Flexible Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.

51 Muirhead Ave. Trenton, N. J.

THIS NUT WILL STAY TIGHT!

because it is held with

PALNUT DOUBLE LOCKING ACTION*

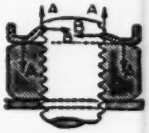
TRADEMARK

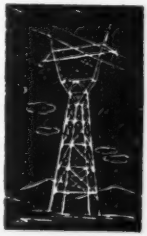
"Pal" Trademark Reg. U. S. Pat. Off.

PALNUT Self-Locking Nuts are inexpensive single thread, tempered spring steel locknuts — easily, speedily spun on top of regular nuts with the fingers, locked tight with a wrench.

*DOUBLE LOCKING ACTION

Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.





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Specify PALNUTS on new lines—add PALNUTS to existing lines, without disturbing regular nut. Eliminate further re-tightening and checkups. Hot Dip Galvanized finish, in all utility sizes.

PALNUTS for terminal connections

Used on transformers, switches, disconnects, etc. Keep terminals tight, eliminate spring washers, assure full conductivity. Plain, Parkerized or Duronze according to needs.

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Expert advice on location and purchase of right of way

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UNDISPLAYED RATE:
(Not available for equipment advertising)
$1.20 a line, minimum 4 lines.
To figure advance payment count 5 average words as a line.
INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of above rate, payable in advance.
PROPOSALS, $1.20 a line an insertion.

INFORMATION:
BOX NUMBERS care publication New York, Chicago or San Francisco offices. Count as 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

DISPLAYED RATE:
The advertising rate is $9.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E. W.

NEW ADVERTISEMENTS received by 10 A. M. August 19th, will appear in the August 27th issue subject to limitations of space available.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ENGINEER FOR Georgia Electric Membership Corporation qualified to head department, must be eligible for registration; experienced in distribution, operation and planning both rural and urban construction; under 40 years of age and with initiative. State briefly qualifications and salary expected in first letter. P-9178, Electrical World.

ELECTRICAL ENGINEER, preferably with some structural experience, familiar with outdoor and indoor substation steel structures, by manufacturer in Midwest. Applicant must be able to design, figure, and sell to electric utilities in central U. S. Administrative ability very desirable. A permanent position with good starting salary and bonus arrangement plus an excellent future for the right man. Address P-9578, Electrical World.

SELLING OPPORTUNITY OFFERED

REPUTABLE LONG established power switching equipment manufacturer wants experienced sales agents familiar central station and general power applications for Florida, Illinois, Michigan, Missouri, Ohio and Carolinas. Write RW-9565, Electrical World.

EMPLOYMENT SERVICES

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (39 years recognized standing and reputation). The procedure is highest ethical standards, is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present positions protected. Send only name and address for details. R. W. Bixby, Inc., 262 Dun Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ENGINEER, GRADUATED electrical-mechanical; 20 years in all branches. Field and office. Consultant, Supervisor, Liaison on large construction projects handling utilities and building construction of communities efficiently. Also survey and reports on Foreign Nations power and industrial exploitation. Anywhere home or abroad. Physically perfect. Age 54 years min. $6000 and up in accordance with location. Highest references possible. Present contract expires September. J. Slingerland, Pleasantville, New York. Phone 2393.

GRADUATE ELEC. Engineer of 30 years of wide all around experience on winding, testing, trouble shooting, general repairing, installation, automatic controls, power plants, substations layout and designing. PW-9628, Electrical World.

ENGINEER-ELECTRICAL, 26 years experience with utilities in supervision, design, construction and maintenance of overhead electric power lines. Excellent references. Registered several states, Member AIEE. PW-9591, Electrical World.

BUSINESS OPPORTUNITY

Electrical Engineer,
thoroughly experienced in estimating and preparing specifications for electric light and power installations. Opportunity for active business participation in N. Y. C. Send resume to BO 9607, Electrical World.

Wanted by Manufacturer

Experienced man to handle sales correspondence and quotations on distribution and power transformers. Should have pleasing sales personality, be an electrical engineering graduate, and have actual sales experience.

P-9373, Electrical World
330 W. 42nd St., New York 18, N. Y.

EXPERIENCED SALESMAN

There's a top sales job in the electrical industry for an experienced salesman with utility engineer and purchasing agent contacts in Wisconsin, Michigan, Illinois and Indiana. Must be E.E. graduate or have equivalent experience.

Excellent opportunity for man in his thirties to grow with one of the most progressive electrical manufacturers in the Midwest.

SW-9555, Electrical World
330 West 42nd St., New York 18, N. Y.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. 2737) will be received by Bureau of Reclamation, Denver, Colorado, August 30, 1949, and then publicly opened for furnishing one vertical-shaft, 70,000-horsepower, 257-rpm, hydraulic turbine with pressure regulator for unit A-9 in the Hoover Power Plant, Boulder Canyon Project, Arizona-California-Nevada. Delivery is desired within 630 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner.
(100)

WANTED

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: Eastgate 7-4778
PIERCE CABLE CO.
2670 Clybourne Ave. Chicago 14, Illinois

FOR SALE

4000 KW TURBINE GENERATING PLANT

Consisting of

1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

A. G. SCHOONMAKER CO., INC.
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Sold!

"It will not be necessary for us to renew our ad in the Searchlight Section of Electrical World as, through your circulation, we have sold the major portion of the meters available for sale."

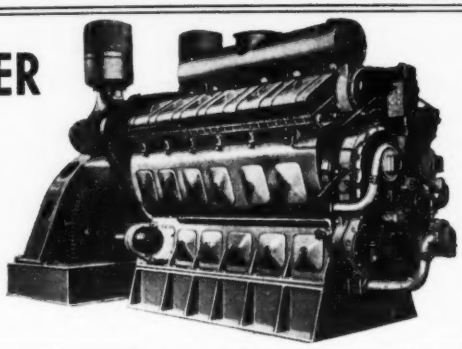
Can "Searchlight" Serve You?

DIESEL ELECTRIC POWER

FOR

IMMEDIATE DELIVERY

UNIT CAPACITIES—10 TO 1420 KVA
A. C.—50 AND 60 CYCLES
ANY VOLTAGE



A PARTIAL LIST OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1420	Fairbanks Morse	38D8 1/8	1600	720	375	Enterprise	DSG-6	450	450
1250	General Motors	16-278A	1600	720	312	General Motors	8-268A	450	1200
1000	General Motors	12-278A	1200	720	187	Ingersoll Rand	S	225	514
937.5	General Motors	12-567	1100	720	125	General Motors	3-268A	150	1200
625	Alco	6-12 1/2x13	750	600	75	General Motors	6043C	90	1200
425	Baldwin	VO-6	510	450	62	Int'l Harvester	UD-18	76	1200

WRITE FOR COMPLETE INFORMATION

Engineered AGSCO DIESEL POWER

A. G. SCHOONMAKER Company, Inc.

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MOTORS SQ. CAGE

1—450 HP.—Ridgeway 900 rpm 2200v.
1—125 HP. G.E., 1800 rpm 2300v.
1—100 HP. Whse. 1800 rpm 440v.
1—100 HP. Whse. 1200 rpm 2200-440v.
1— 75 HP. Whse. CS. 1200 rpm. 2200 volts. 3 phase. 60 cycle.
1— 75 HP. 1800 rpm Westinghouse. 440 volt.
1— 75 HP. General Electric Type KT 900 RPM 440 volt.
2—40 HP. G.E., 900 rpm 220v.
40/20 HP. Westinghouse 600/450 44 volt.

MOTORS SLIP RING

1—2500 HP G.E. MT 217 RPM 6600 volt.
2— 150 HP G.E. Type IM 450 RPM 440 volt.
1— 100 HP G.E. Type IM 400 RPM 440 volt.
1— 100 HP G.E. 720 rpm 440v, 25 cy. IM.
75 HP. G.E. 1200 rpm 220v, 60 cy. Vert.
60 HP. West. 900 rpm 220v. 60 cy. Vert.
50 HP. F.&M. 1800 rpm 220v. 60 cy.

MOTORS—D. C. 230 VOLTS

1—125 HP. G.E. 1800 rpm B.C.
1— 75 HP. 865 rpm General Electric.
1— 50 HP. 700 rpm Crocker-Wheeler.

VARIABLE SPEED—220 VOLTS

1—35 HP. 300/1200 rpm Westinghouse.
1—30 HP. 440/1200 rpm General Electric.
2—25 HP. 650/2200 rpm Westinghouse.
2—25 HP. 300/900 rpm Electric Dynamic.
1—35 HP. 500/1500 rpm General Electric.

MOTOR GEN. SETS

1—1000 KW Westinghouse 275 volt, 720 RPM 4000 volt Syn.
1—1000 KW General Electric 600 volt 514 RPM 4000 Volt Syn.
1—500 KW. G.E. 250v 900 rpm 2300v Syn.
1—500 KW. G.E. 575v 900 rpm 2300v Syn.
1—125 KW. Crocker Wheeler 1200 rpm 125v Generator 2200v S.C. Motor.
1—400 KW. Elect. Mach. 1200 rpm 125v Generator 4150 Syn. Motor.

PLATING GENERATORS

1—1½ KW. G.E. 5/6v with sq. cage mt.
1—12 KW. Hansen Van Winkle 24v 1200 rpm. 20 HP. General Electric KF Motor.
1—3000 Amp. Chandeysson, 6/12v 400 rpm Syn. Motor.
1—2500 Amp. ditto.
1—625 KVA West. Reduction Gear Turbo Generator Non-Condensing, 2400v 3 ph 60 cy.

TRANSFORMERS

1—1000 KVA G.E. 3 ph. 4150 volt to 2400 volt.
3— 400 KVA G. E. 6900 V. Pri.—2300 V. Sec.
3— 300 KVA Pitts. 2300v pri. 115/230v sec.
3— 200 KVA G.E. type H. 2300v pri. 115/230v sec.
3— 150 KVA West. 2300 volt Pri. 240/480 sec.
1— 150 KVA G.E. 2300v 110-220v.
3— 100 KVA G.E. 4150v. 240/480v. Pyranol.
3— 100 KVA G.E. 4150 v 230/460 v Pyranol.
3— 75 KVA Amer. 2400v. pri. 240/480 sec.
6— 50 KVA West. 2300 v. 120/240 v. Inerteen.

ALTERNATORS & SYNCH. MOTORS

1—2500 KVA Westinghouse, Syn. condenser, 720 rpm 2200v with D.C. exciter.
1—320 KVA Allis Chalmers, 450 rpm 480v.
1—240 KVA General Electric ATB, 600 rpm 240v with D.C. exciter.
1—225 KVA 514 rpm 600v Westinghouse.
4—200/100 HP. Whse. 720/360 rpm 4150v.
1—200 HP. General Electric 257 RPM 440 volt.
1—100 HP. G.E. type TS 600 rpm 4400v D.C.
2—150 HP. Allis Chalmers, 360 RPM, 2200 volt.

Complete Line of A.C. and D.C. Motors and Generators

TRANSFORMERS

FOR SALE

10	1½ KVA	Wag	7200—120 240
50	5 KVA	G-E	2300—115 230
6	5 KVA	W-H	13200—120 240
3	50 KVA	W-H	4800/8320Y—120 240
3	50 KVA	Pitts	26400—2300/4000Y
3	50 KVA	G-E	33000—2400/4160Y
3	75 KVA	W-H	230 460—115 230 DRY
3	100 KVA	G-E	11000—2300/4000Y
3	100 KVA	G-E	33000—2300/4000Y
3	150 KVA	L-M	2400/4160Y—120 240
3	150 KVA	G-E	6600—440
3	150 KVA	G-E	22000—2300/4000Y
2	200 KVA	G-E	6900/11953Y—450 230 115
1	200 KVA	G-E	6599/11433Y—2300
3	200 KVA	Mol	7233/12473Y—219 439 25 cyc.
3	333 KVA	G-E	33000—2300/4000Y
1	400 KVA	G-E	132000—120 240

Many other items in stock

TRANSFORMERS

WANTED

Reliable rewind and repair service on all makes of transformers.

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

For Sale

Generator Voltage Regulators

General Electric GDA, Westinghouse Silvertat, Allis-Chalmers Rocking Contact, for AC and DC Generators All Sizes Available for Quick Delivery.

Western Regulator Exchange
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ELECTRICAL CABLE

- for every industrial and power application.
- Specialconstructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2670 N. Clybourn Ave., Chicago 14, Ill.

TO HELP YOU

Sell Equipment You No Longer Need Use

"Searchlight" Advertising

"SUCCESSFUL OPERATION GUARANTEED" Belyea

We Rebuild in accordance with N.I.S.A. Standards

D. C. MOTORS

Qu.	HP	Make	Type	Volts	Speed
1	2000	Whse.		600	600/720
1	1750	Whse.		600	550/700
2	1500	Whse.		525	600
1	1200	Whse.		600	525/700
1	700	G.E.	MCF	600	150/525
1	650	G.E.	MPC	250	115/145
1	600	Whse.		600	800/950
2	600	G.E.	MPC	600	600/720
1	335	Whse.	MQ	250	300/900
1	300/300	G.E.	MPC	220	360/920
1	275	Whse.	QM-600.6	230	425/850
1	250	G.E	MPC	230	400/800
1	230	Al. Ch.		230	700
3	150	Whse.	SK-200	230	600
1	150	Cr. Wh.	CMC-65H	230	1150
1	150	G.E.	MPC	230	230/450
1	140	Cr. Wh.	152HL	230	300/1050
3	150	Cr. Wh.	TEFC-87H	230	890
1	150	G.E.	CD-B-Brg.	600	250/750
2	125	G.E.	CO	230	625
1	125	El. Dy.	308	230	750/1560
1	115	Cr. Wh.	JHL	230	1200
1	100	G.E.	CD-175	230	365/730
1	100	G.E.	MPC	230	225/450
3	100	Whse.	SK-Vert.	230	485/950
1	100	Rel.	1050T	230	400/1200
1	80	El. Dy.	308	230	475/950
3	75	Cr. Wh.	53H-TEFC	230	860
1	75	Whse.	SK-180	125	650
2	75	G.E	CDM-1126Y	230	2000
2	75	El. Dy.	258L	230	750/1750
1	75	Cr. Wh.	CMC-65H	230	500/1500
3	60/75	Whse.	SK-200	115	300/700

SYNCHRONOUS CONDENSERS

Qu	KVA	Make	Type	Volts	Speed
1	5140	Wh.e.		4150	600
1	4000	G.E.	TSC	2400/4150	900
1	3000	Whse.		2400	720

MOTOR GENERATOR SETS
3 Ph. 60 Cycle

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	2000(30)	Whse.	720	600	2300
1	1800	G.E.	360	275	2200/4400
1	1500	G.E.	600	600	4150
1	1500	Whse.	600	600	4150
1	1250	G.E.	600	275	2300/4150
1	1000	Cr. Wh.	720	250	2300/4150
1	1000	G.E.	720	250	13200
1	1000	Whse.	514	250	4000
1	1000	Whse.	720	600	2300/4150
1	1000	Whse.	900	600	2300/4150
1	800	SUGE	1200	240	2300
1	800	G.E.	720	125	2300/4150
1	500	G.E.	720	600	4400
1	750	Whse.	720	275	2300/4150
1	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	350	G.E.	900	125	4150
1	300	G.E.	1200	120/240	440
1	250	Whse.	1200	240	440
1	150	Cr. Wh.	1200	250	220/440
1	140	Cr. Wh.	720	125/250	2200

ROTARY CONVERTERS (60 cycle)

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	2000	G.E.	514	600	13200
1	2000	G.E.	450	600	13200
1	1000	Whse.	900	600	11000
1	750	Whse.	900	600	13200
1	500	Whse.	900	250	6600

All units can be furnished with AC and DC Control

MERCURY ARC RECTIFIERS

1	1000	Al. Chal.	B-612	625	13500
*1	1000	B-B	25/60 cy	625	5600/11200
1	750	G.E.	KHW	575	2300/4000

*Complete with full automatic A.C. and D.C. controls.

A. C. MOTORS—3 Ph. 60 Cycle

Synchronous

Qu.	HP	Make	Type	Volts	Speed
2	3500	G.E.	TS	2300	257
1	2100	G.E.	ATI	4600	514
2	2000	Whse.		2200	120
1	1470	Whse.		2300/4600	900
1	1000	Whse.	MILL	2300	189
2	900	Al. Ch	Eng (new)	2200	150
1	600	Whse.		440	360
1	500	G.E.	ATI	480	900
1	500	G.E.	TS-6832	4160	600
1	450	Whse.		2200	128.5
2	350	G.E.	TS	2200	150
1	320	G.E.	ATI	2300	600
1	306	Al. Ch.		440	600
1	300	G.E.	ATI	440	720
1	300	Whse.	Eng.	2300	720
1	225	G.E.	ATI	440	900
2	125	G.E.	ATI	440	450

Slip Ring

1	1000	Whse.	CW	2300	705
2	700	Whse.	CW	2300	900
1	600	G.E.	MT	440	720
1	500	G.E.	IP	550	505
3	450	G.E.	IM	440	505
1	500	G.E.	MIII-IM	2200	450
3	350	Whse.	CW	2200	900
1	350	G.E.	MT-442y	4000/23	257
1	300	A. Ch.	ANY	2300	505
3	300	Al. Ch.	ANY	2300	705
1	250	G.E.	MT	4000	257
1	250	G.E.	MT-5388	2200	750
4	125	G.E.	MT-566Y	2300	435

Squirrel Cage

1	250	G.E.	KT-550	440	1780
1	200	G.E.	KT-557	440	1800
1	200	G.E.	IK	550	865
1	125 (new)	G.F.S.	KF TEFC	440	1190
1	125	G.E.	KF-6328L	440	3555
2	100	G.E.	KT-543	220/440	1780

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Belyea COMPANY, INC.

MAIN OFFICE AND SHOP
51 HOWELL ST., JERSEY CITY, N. J.

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UNITS UP TO 5000 KW
AVAILABLE IN STOCK

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Winch Trucks, Construction Trucks With Utility Bodies

We have 20 Fords and Brockways with transmission winches and derricks that were formerly used by the Telephone Co. They are in extra good mechanical condition and are suitable for Electrical Contractors, Tree Work or many other lines of Construction.

Prices range from $400.00-$750.00.

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Tel.—MYstic 6-7346

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS
1000 KW TO 100 KW
STATIONARY AND PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

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3—833 KVA General Electric, Type H. form KD, O.I.S.C. outdoor Transformers, single phase, 60 cycle, 22000 volt H.T. with taps, to 4000 volt L.T.

TIPPINS MACHINERY CO.
1001 Washington Blvd., Pittsburgh 6, Pa.

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3 PHASE FEEDER VOLTAGE REGULATORS
FOR SALE

Due to a change in our distribution system we have removed from service and have for sale, 3 General Electric and 5 Westinghouse, 10% buck or boost, 2400 volt, 3 phase feeder voltage regulators. These regulators vary in size from 20 Kv-a to 52 Kv-a and can be purchased for approximately 10% of original cost. If interested, address inquiry to

RUMFORD LIGHT COMPANY
RUMFORD, MAINE
Att: C. T. Maynard, Engineer

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12—1000 KVA G.E. Pri. 2300 to 13200 Sec. 230 to 2300, 1 Ph. 60 Cy.
9—300 KVA West. Pri. 2300 to 13200 Sec. 230 to 2300, 3 Ph. 60 Cy.
3—75 KVA G.E. Pri. 2300 Sec. 230/115, 1 Ph. 60 Cy.
2—150 KVA Eisler Pri. 2300/4600 Sec. 230/460 3 Ph. 60 Cy.
3—150 KVA G.E. Pri. 2300/4000Y Sec. 115/230 1 Ph. 60 Cy.
3—100 KVA G.E. Pri. 6900/11950Y Sec. 230/460 1 Ph. 60 Cy.
1—1000 KVA West. Pri. 2300/13200 Sec. 230/2300 3 Ph. 60 Cy.

PARTIAL LISTING — SEND US YOUR INQUIRIES — WE HAVE IT. TRANSFORMERS BUILT TO YOUR SPECIFICATIONS, REPAIRED AND REWOUND.

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Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

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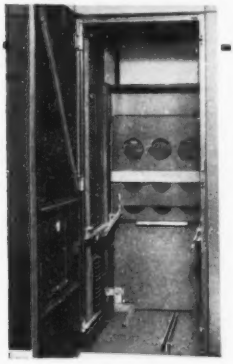
Are You *Really* Interested in Getting More for Your Money?

➽ For years, I-T-E has maintained leadership in the circuit breaker and switchgear industry. Today, I-T-E invites you to look over the special built-in features which have become a part of its "standard price" switchgear . . .



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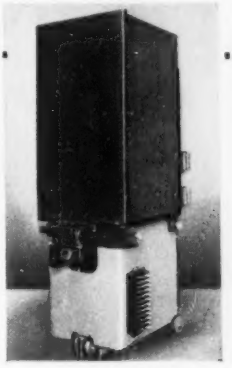
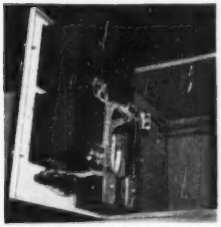


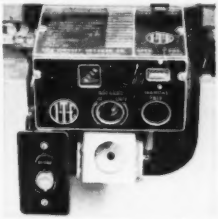
PLANNED FOR GREATER
SAFETY



METERS AND RELAYS are mounted on a *Relay Panel* designed for that specific purpose. Why?

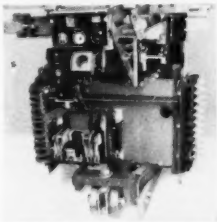
a. Delicate relay mechanisms are not subjected to "operation by vibration" when circuit breaker doors are opened or closed or bumped.

b. The Relay Compartment is just that. The secondary wiring, control bus, and relays are together, *where you want them*, not where manufacturing economy dictates.



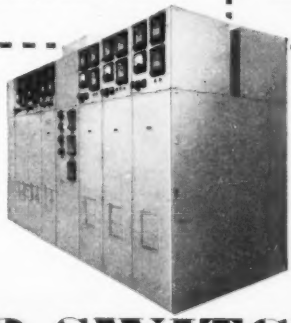
TESTING CIRCUIT BREAKER operation within the structure is no longer a chore.

a. Release a catch, move the breaker $4\frac{1}{2}$ inches, and you are ready to test. An electrical close-trip test-switch is furnished on every breaker unit. Test control circuits are automatically set up. No jumpers, no plugs, no push, no pull. Easy does it!



HIGH IMPULSE CIRCUIT BREAKERS

If you are impulse conscious you are familiar with the present interim test that permits circuit breakers of the 5KV class to be subjected to a 45KV impulse test across the open contacts. Type HV breakers are tested to withstand a 60KV impulse — phase to phase, phase to ground, and across the open contacts.



COORDINATED IN MULTUMITE BOARDS

I-T-E HV MULTUMITE Switchgear assemblies coordinate efficient I-T-E HV Air Circuit Breakers with transformers, meters, bus, and instruments into a single, efficient unit. I-T-E HV Air Circuit Breakers are rated at 5KV, 7.5KV, and 15KV — 600 A., 1200 A., and 2000 A. continuous; 50MVA, 150MVA, and 250MVA interrupting

These are but a few of our better points. There is an I-T-E Field Application Engineer in your area. Permit him to tell you of other advantages, and to assist in your switchgear planning.

POWER SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY, 19th & Hamilton Streets, Philadelphia 30, Pa.
31 Offices in United States · In Canada, EASTERN POWER DEVICES, Ltd., TORONTO
For Export: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • POWER CIRCUIT BREAKERS
MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

R&IE

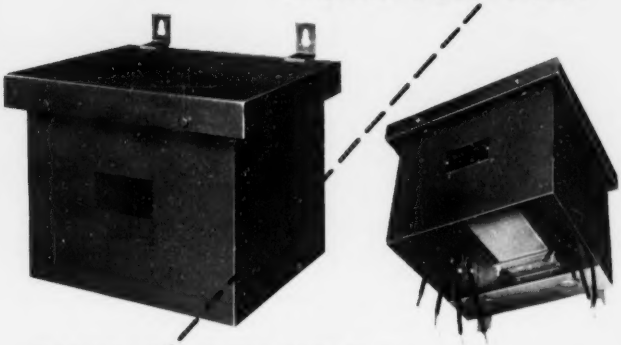
* *For power switching equipment refer to Railway & Industrial Engineering, an I-T-E organization*

KUHLMAN FACT FILE
DRY TYPE TRANSFORMERS

DO YOU BUY TRANSFORMERS BY HABIT OR BY MERIT?

NO. 3 OF A SERIES

HERE'S HOW KUHLMAN DRY-TYPE MERITS WORK FOR YOU!



7½ KVA Kuhlman Dry Type Transformer, 240/480 volts primary, 120/240 volts secondary, 60 cycle single phase, Class B insulation. Interior view at right shows terminal leads and roomy terminal compartment. Louver panel is removed.

BENT IRON CORE—Made of high grade oriented cold rolled steel . . . saves weight, lowers exciting current and impedance . . . gives better regulation and performance!

ROCKBESTOS CABLE—All leads from the coil are made of this highly heat-resistant material!

AMPLE VENTILATION—Louver panel assures proper ventilation. Few turns of a screwdriver removes it to allow quick access to core and coil!

ROOMY TERMINAL COMPARTMENT—Space below core and coil provides plenty of room for making connections!

HANDY KNOCKOUTS—Conduit knockouts in sides and bottom provide handy connection openings!

LIGHT WEIGHT—Kuhlman's famous Bent Iron Core, simplified design and absence of oil makes transformers smaller, lighter, easier to handle!

MOISTURE PROTECTION—Special heat resistant varnish protects windings against moisture and binds insulation and component parts into a unified structure. The next time you buy dry type transformers, don't buy blind—get acquainted with the merit points of Kuhlman dry types!

We know you're already sold on the merits of dry types themselves—how they deliver high voltage right to the load centers, thereby eliminating costly long runs of heavy copper, reducing operation losses and improving voltage regulation. That's why dry types like the Kuhlman Unit above are ideal for more efficient operation of lighting circuits, motors, machine tools and other electrical equipment.

This transformer may be mounted right on the wall near the machine it is serving. It is cooled directly by air without the use of liquid. This eliminates costly fireproof vaults, cuts maintenance costs. Transformer's compact size and light weight saves on installation time and space.

3 to 10 KVA single phase, 9 to 25 KVA three phase, Kuhlman transformers are built with Class B insulation, 80°C temperature rise with safety, composed of glass, mica and asbestos in accordance with A. I. E. E. standards.

The complete Kuhlman line of dry type transformers covers ¼ to 500 KVA single phase, with voltages up to 15,000 volts; up to 1500 KVA and 15,000 volts three phase. The line includes wall or floor mounted types for machine tools and lighting circuits as well as huge indoor power centers like the one shown at right.

KUHLMAN ELECTRIC

Kuhlman ELECTRIC COMPANY

BAY CITY, MICHIGAN

EXPORT REPRESENTATIVES *International Standard Electric Corporation,*
67 Broad St., New York City 4, N. Y. Cable Address, Microphone, N. Y.

TRANSFORMER TOPICS by KUHLMAN

QUESTION: How are voltage ratings of three-phase transformer windings designated?

ANSWER: Due to the various methods of operating three-phase systems, several different types of transformer windings must be developed to meet these conditions. To avoid confusion in positively identifying these windings, a nomenclature has been developed by the transformer users and manufacturers. A three phase winding is designed for delta, wye, or delta and wye operation.

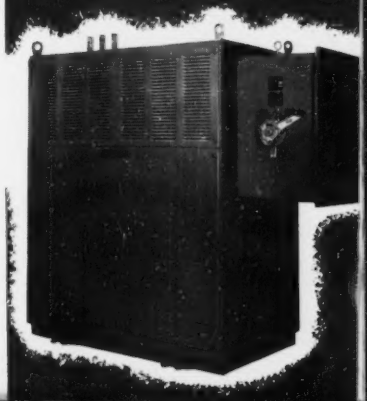
If the winding is for delta operation only, the line voltage is given followed by the symbol Δ. For instance a winding designed for 2400 volt delta operation only is designated by 2400 Δ.

A winding designed for wye operation only, with the neutral fully insulated but not available, is designated by the line voltage followed by Y.

Thus, a winding designed for 4160 volts wye only is indicated by 4160Y.

Windings designed for four wire wye operation with the neutral fully insulated and brought out are designated by the wye voltage followed by Y, slant, and the voltage from line to neutral. 12470Y/7200 indicates that the winding is suitable for operation at 12470 wye with 7200 volts available from line to neutral.

In the case where a winding is designed for four wire wye operation with the neutral brought out with reduced insulation and grounded, the correct designation is the wye voltage followed by a slant and Grd Y.

Thus, 115000/Grd Y designates a winding suitable for four wire wye operation at 115000 volts with the neutral grounded.

A special designation is provided in the 14400 class to take care of two different tap arrangements. 14400 Δ indicates a transformer suitable for operation at 14400 volts Δ with taps at 14100, 13800, 13500, and 13200 while 14400/13200 Δ indicates a transformer suitable for operation at 14400 delta with taps at 13800 and 13200.